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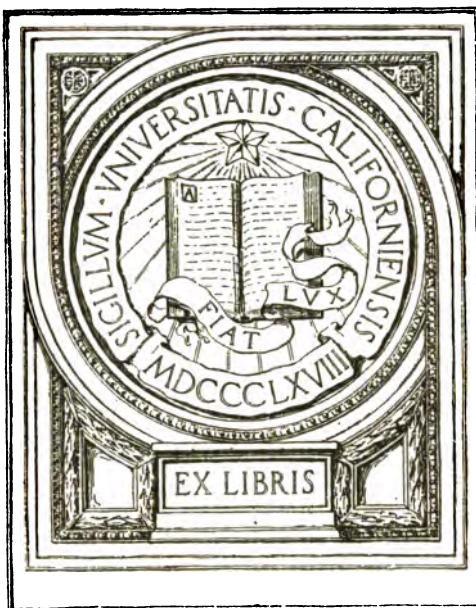
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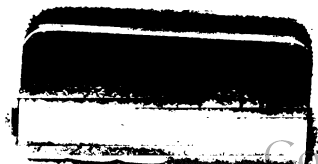
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No. 1693

INSTRUCTIONS FOR MOUNTING
USING, AND CARING FOR

DISAPPEARING CARRIAGE

A. R. F., MODEL OF 1896

FOR

10-INCH RIFLES

MODELS OF 1888 AND 1895

(EIGHT PLATES)

APRIL 28, 1904
REVISED DECEMBER 21, 1907



WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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1896

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ILLUSTRATIONS.

The following drawings of this carriage are published with the instructions, viz:

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[No. 1693]

(3)

INSTRUCTIONS

FOR

MOUNTING, USING, AND CARING FOR DISAPPEARING CARRIAGE, A. R. F., MODEL OF 1896, FOR 10-INCH RIFLES, MODELS OF 1888 AND 1895.

[The points in italics are of importance, or concern the safety of the carriage, and should be specially noted.]

GENERAL DESCRIPTION.

The carriage is designed to mount guns of either the model of 1888 or the model of 1895, and the emplacement and the carriage permit an *all-round fire* or motion in azimuth of 360°. To obtain this motion in azimuth, the center of motion of this carriage is farther to the rear than on carriages of similar design, and the gun and carriage rest upon two sets of base rings and racers and two sets of traversing rollers working on concentric paths contained in the racers and base rings.

PRINCIPAL PARTS.

The carriage consists of the following principal parts, viz: Base rings, azimuth circle, traversing-roller systems, racers, chassis, transoms, top carriage, recoil and counter-recoil system, gun levers, cross-head, tripping gear, counterweight, bottom plate, elevating arm and rack, elevating system, retracting system, traversing system, sighting standard and platforms, accessories, including ammunition trucks, shot tongs, and implements.

ACTION OF CARRIAGE.

Upon firing the piece the gun-lever axle moves to the rear, carrying the top carriage with it. The lower ends of the levers move vertically upward, being constrained by the crosshead traveling on the vertical crosshead guides. The trunnions of the gun move downward and to the rear in the arc of an ellipse. The energy of recoil is absorbed partly by raising the excess of the counterweight and partly by the movement of the masses up the inclined chassis rails, but principally by the resistance of the recoil cylinders, and when the gun comes to rest it has the proper loading angle.

The elevating system is so constructed that the gun is at an angle of about 5° elevation when in the loading position, if recoiled to the fifteenth notch, with any elevation in battery. After loading, the pawls are tripped and the excess of the moment of the counterweight over the moment of the gun, etc., enables it to raise the gun to the firing position. If this excess be small, the velocity of counter recoil will be slow; but if more counterweight be added, the velocity will increase and the time required for going into battery will decrease.

EXTERIOR BASE RING.

The exterior base ring is made of cast iron in eight segments, bolted and keyed together, and is held in position on the foundation by thirty-two 1.75-inch bolts. Sixteen bronze screws for leveling this base ring are provided near the foundation bolts. They are set against steel plates, and are used to level the carriage. Sixteen leveling wedges are also provided for setting this base ring. The base ring has a lower roller path on its upper surface. A dust guard made in sections and bracketed to the base ring protects the outer traversing rollers.

INNER BASE RING.

This base ring is made of cast iron, in one piece. It is held in position on the foundation by twelve 2-inch bolts. Twelve bronze screws for leveling this base ring are provided in addition to 12 leveling wedges. This base ring also has a lower roller path, and in addition forms one part of the pintle of the carriage.

AZIMUTH CIRCLE AND POINTER.

A brass azimuth circle, attached by countersunk screws to the top of the outer dust guard, is graduated to degrees, the numbers of which are to be added after the carriage is erected in its emplacement. To a flange provided at the outer edge of one of the segments forming the exterior racer is fastened the azimuth pointer. The pointer is graduated in decimals of a degree, the least reading being five-hundredths of a degree. It is also provided with slotted holes to give it lateral motion for adjustment, after which it is fixed in position by two dowels. The pointer is protected by a hinged bronze cover.

EXTERIOR RACER.

This racer is made in six segments, five of which are of cast iron and one of cast steel, the largest diameter being 25.66 feet. On the underside there is an annular projection 2.75 inches deep which is bored to fit over a corresponding projection from the base ring, but the diametral clearance being 0.2 inch, this projection does not form the pintle, which is provided for on the inner racer. An upper roller

path is formed on the underside of the racer. In one of the segments cleaning holes for the roller path have been provided, which when not in use are covered by steel plates. Four rectangular-shaped holes, 4 by 9 inches, each located diametrically opposite one of the others, are made for the insertion of the leveling gauge. A hinged door in the floor plate permits entrance to the counterweight pit by means of a ladder fastened to the floor-plate supports.

INNER RACER.

This racer is made of cast steel in one piece. An annular projection on the underside, 3.5 inches deep, is finished to fit over a corresponding projection from the inner base ring, forming the pintle of the carriage. An upper roller path is also formed on the underside of this racer. Spiral oil grooves on the pintle, access to which is obtained by means of oil tubes leading from the floor plates, lubricate the pintle. A dust guard is attached to the outside of the racer for the protection of the traversing rollers and path.

TRAVERSING ROLLER SYSTEM.

The racers rest and rotate upon two concentric circles of live, conical, traversing rollers which are guided by trunnions with bearings in the distance rings. The outer traversing rollers are 48 in number and the inner ones 24, all made of forged steel. The distance rings for the exterior traversing rollers consist of two concentric circles of wrought iron, 1.125 by 4.5 inches in section, each made in four segments held together by fish plates and tap bolts. Twenty-four cast-iron separators, equally spaced, are secured to the distance rings by through bolts, thus keeping the rings together and permitting two rollers between each space thus formed. The distance rings for the inner traversing rollers are similar in construction to the outer rings, except that they are made in two segments, and being smaller are held in proper relative position by 12 cast-iron separators with through bolts.

CHASSIS AND TRANSOMS.

The two chassis of cast iron are bolted to the racers, the forward ends of the chassis being secured to the cast-steel segment of the exterior racer and the middle and rear of the chassis to the inner racer. The chassis are united at the middle by two cast-steel transoms, the rear one of which carries the elevating rack and a portion of the gearing. The upper surfaces of the chassis form the recoil roller path, and slope $1^{\circ} 20'$ to the front to facilitate the return of the piece to firing position, thus reducing the necessary preponderance of the counterweight.

[No. 1663]

TOP CARRIAGE AND RECOIL ROLLERS.

The top carriage, which is similar to that of an ordinary barbette carriage, is made of cast iron in one piece. It consists of two side frames, containing the beds for the gun-lever axles, and two recoil cylinders, all united by a transom. It rests upon two sets of thirteen live recoil rollers running on journals contained in the rollers. These rollers are set into movable steel frames provided with bronze bushed bearings, which fit the roller journals. The rollers are of forged steel, 5 inches in diameter, and are flanged on both ends to guide the top carriage upon the chassis. They move to the rear with the top carriage at half its speed and travel half as far.

RECOIL AND COUNTER RECOIL SYSTEM. (See Pl. V.)

The recoil cylinders are 9.5 inches in interior diameter, fitted with piston rods 3.5 inches in diameter, having pistons forged solid with them. The piston rods pass through lugs which project upward from the front ends of the chassis rails and are secured by the piston-rod nuts and check nuts. The piston rods project through the rear ends of the cylinders and are supported in rear by brackets bolted to the ends of the chassis rails. At the ends of the cylinders there are the usual stuffing boxes with glands and followers.

To secure equal resistance and equal fluid pressure in the two cylinders an equalizing pipe connects their front or pressure ends. In this pipe is a combined emptying coupling and throttling valve, by which the whole recoil system can be emptied of oil. From the throttling valve connecting pipes extend back to the rear ends of the cylinders.

The energy of recoil is taken up in small part only by the raising of the counterweight and by the movement of the top carriage up the inclined path, the greater portion being controlled and taken up by the resistance of the hydraulic cylinders.

In any hydraulic break the resistance is greater as the velocity of the piston in the cylinder is greater and as the openings for the passage of the liquid are less. The velocity of retarded recoil of the top carriage being variable and a constant resistance being desired, the orifices are usually varied in such manner that the relation between the velocity and the area of the orifices is at all points such as to give a nearly constant resistance.

The general arrangement of the hydraulic cylinders, pistons, equalizing and connecting pipes, throttling valve, and emptying coupling of disappearing carriages is shown on Pl. V, to which these parts of this carriage conform in essential principles, features, and positions. The relative positions of parts shown on that plate are those which exist in the "in battery" position.

When the gun is fired the piston remains stationary while the top carriage (in which are the cylinders) moves to the rear. The motion of the top carriage is retarded and finally stopped, principally by the resistance which the oil in the cylinders offers to being forced from one side of the piston to the other, through the following openings:

1. The clearance between the walls of the cylinder and the piston, necessary for working movement. This opening is of constant area.

2. The orifices between the throttling bars and their slots in the piston. These openings vary with the profile of the throttling bars, since the slots, which are partly closed by these bars, are of constant area.

3. The opening of the throttling valve which controls the flow through the pipes connecting the front and rear ends of the cylinders. This opening is of constant area during recoil, but can be completely closed or changed to suit different conditions of loading and to correct for any other conditions that would cause a variation in the length of recoil.

The two throttling bars in each cylinder are constructed of constant width with only a sufficient lateral clearance in the slots for working movement, and of varying depth, the profile being so designed that the area of the orifices (the portions of the slots not filled by the bars) for the escape of the oil past the piston increases from the beginning of motion up to the point where the velocity of retarded recoil of the top carriage is greatest; beyond this point the velocity of retarded recoil of the top carriage is continually decreasing and the area of the orifices decreases continually until it becomes zero at the end of recoil. The orifices have at each point of recoil such a relation to the velocity of retarded recoil of the top carriage at that point as to give nearly a constant resistance to the motion of the top carriage. This results in a nearly constant fluid pressure in the cylinders.

The areas of the orifices have to be calculated for a particular set of conditions of loading, and any variation in these conditions will change the length of recoil of the top carriage, and consequently the height and inclination of the breech of the gun in the recoiled position. As the standard conditions of loading do not always exist, it has been found desirable to provide means for varying the resistance of the hydraulic recoil brake in order that the prescribed length of recoil (bringing the gun into the prescribed loading position) may be obtained under any conditions, standard or not standard—as, for example, when practice charges are fired.

For this purpose the equalizing pipes connecting the two cylinders connect with a connecting pipe, affording a passage which can be completely closed or changed in area by the *throttling valve*, and by which the oil can pass from one side of the piston to the other, i. e.,

from one end of the cylinders to the other. *This throttling valve can be adjusted to give openings varying by 0.013 square inch from 0 to 0.4 square inch.* The graduations of the valve are stamped on the top of the body, there being 10 divisions, numbered 0, 0.04, 0.08, etc. *One and one-half turns of the valve effects a change of 0.04 square inch in the opening.* One complete turn of the valve yoke generally changes the length of recoil by the equivalent of two or three notches on the crosshead rack. This is liable to vary by a notch or more for different carriages or for the same carriage under different conditions.

The setting of the valve best suited to different conditions of loading full or practice charges etc., can be determined only by experience in actual firings with each particular carriage. Different carriages may require different settings, and the same carriage may even at different times require different settings for the same conditions of loading if it is in a materially different condition as to cleanliness and lubrication of the working parts, etc. It is necessary, therefore, that careful records be kept, not only of the setting of the valve, the conditions of loading and recoil, but also of the elevation of the piece and any abnormal condition of the carriage which might affect the freedom of its operation. These records should be studied in the light of all these circumstances to obtain perfect working. However, the ammunition trucks are so designed that the loading position may vary somewhat without material inconvenience, and it is generally possible after a few firings with a carriage to determine the settings of the valve which will result in the gun coming into a proper loading position for any conditions of loading. *For full charges the valve should, in the lack of experience with the particular carriage, be opened to about 0.12 square inch, but not more.*

A padlock is provided for locking the valve yoke in any position to guard against accidental or unauthorized changes in the position of the valve after it has been set. The valve should habitually be kept locked, but this should not be understood as discouraging examination and manipulation of the valve, which are, on the contrary, highly desirable for the sake of familiarizing the personnel with its construction and operation. The cylinders are provided with filling plugs. *In filling, the filling plugs should be removed from both cylinders so as to permit the air to escape and thus insure the filling of both cylinders up to the filling holes.*

After the cylinders have been completely filled, $1\frac{1}{2}$ gallons of oil should be removed from the system in order that voids may be formed in each cylinder to permit expansion of the oil. After the position of the filling plug in each cylinder has been moved forward, the withdrawal of the oil from the system will not be necessary, since when the cylinders have been filled as full as the new position of the

filling holes will permit, the required void for expansion of the oil will be left.

A neutral oil, of specific gravity about 0.85 (such as the "hydro-line" at present issued), is used, and with this oil the working pressure in the cylinders is about 800 pounds per square inch. A denser oil would cause a higher pressure in the cylinders and therefore shorten the recoil slightly. About 32 gallons of oil are required to fill the cylinders and pipes of one carriage.

For the purpose of reducing the shock of accidental excessive recoil, recoil buffers, made up of alternate layers of balata and steel plates, are placed on brackets bolted to the rear of the chassis, where they will be struck by the upper ends of the gun levers if the gun is retracted or recoils beyond its proper position.

The notches between the ratchet teeth cut on the front faces of the crosshead clips are numbered from the top, the numbers being opposite the notches. When the pawl teeth engage in the fifteenth notch the gun is in its calculated loading position, *below which it should not be retracted*. By a proper adjustment of the throttling valve the recoil of the gun should not vary much from this position. The ammunition truck will, however, permit the gun to be loaded anywhere between its position when the pawls engage in the twelfth notch and the lowest possible position—gun levers on the balata counter-recoil buffers.

In case the gun recoils far enough for the pawls to engage, but not sufficiently far for loading, it may be brought down by the use of the retracting gear.

From the foregoing description of the recoil system, it should be evident that should the carriage recoil too freely the proper correction is in a diminution of the opening of the throttling valve, not in an increase of the counterweight. On the other hand, the counterweight alone should be changed to correct or modify the counter recoil.

The amount of counterweight can be determined by trial. However much of the counterweight furnished be used, it will not materially affect the length of recoil.

COUNTER-RECOIL BUFFER.

The counter-recoil buffers are formed by annular projections screwed on the rear cylinder heads, fitting into corresponding recesses in the piston heads with a diametrical clearance of 0.008 of an inch. When the gun returns to the firing position the liquid caught in the recesses in the piston heads can escape only through the small clearance between the projecting buffer and the walls of the recess, thus acting as a hydraulic buffer or dashpot to check the velocity at the end of the return "into battery." At the front end of the chassis

rails counter-recoil stops are provided to prevent the bottoming of the projecting counter-recoil buffers in the annular recesses. Against these stops the top carriage abuts when in the firing position. Lugs project from the lower front part of the top carriage, which serve as fulcrums for pinching bars held horizontally and engaging with teeth cast on the chassis rails, by which arrangement the top carriage may be moved forward to the firing position against the stops if from any cause it should fail to come fully into battery. When time permits, the top carriage should always be brought fully into battery (against the stops); but, if desired, the gun may be fired when the top carriage is as much as 3 inches out of battery with perfect safety and with no bad results other than inaccuracy in the elevation of the gun, unless its elevation be given by telescopic sight on gun trunnion or by quadrant on the gun.

GUN LEVERS.

The trunnions of the guns rest in bronze-bushed trunnion beds in the upper ends of the gun levers.

These two levers are made of cast steel connected at a point a little below their middle by the forged-steel gun-lever axle, which is forced into the levers and keyed. The gun levers are supported by this axle, the projecting ends of which serve as trunnions supported by and rotating in the bronze-bushed axle beds in the upper part of the side frames of the top carriage. They are secured therein by forged-steel axle caps, also bronze-bushed.

CROSSHEAD.

The lower ends of the gun levers are connected by crosshead pins to a cast-steel crosshead, which supports the counterweight.

Crosshead clips formed in one piece with the crosshead are lined with bronze and engage over crosshead guides cast on the inside of the chassis rails. These guides constrain the crosshead to move in a vertical direction. Ratchet teeth are cut on the front faces of the clips to be caught by pawls pivoted to the chassis rails, and in this way the counterweight is held up and the gun is prevented from returning to the firing position after recoiling.

TRIPPING GEAR.

After the gun is loaded it is permitted to rise to the firing position by raising the tripping levers until they are latched and immediately left in that position.

The action is entirely automatic after the levers have been moved sufficiently to allow the carriage to start into battery, at which time they are caught by the safety latch, so that the pawls are held out of the way of the rack until the latter has passed entirely below them,

when they are released from the latch by the automatic action of the dog attached to the crosshead, and are returned by the moment of the weight of the tripping levers, etc., to their proper positions ready to engage the crosshead when it again rises. The tripping levers should not be held up by hand after the carriage starts into battery. The pawls may be tripped by the use of one or both levers. Should the levers be raised while the gun is in battery, engagement of the safety latch will be prevented by the form of the dog.

COUNTERWEIGHT, BOTTOM PLATES, AND SUSPENSION RODS.

The cast-iron counterweight bottom plate and the two rods which suspend it from the crosshead form the cage which carries the lead counterweight. The counterweight is piled in the cage in layers of different thicknesses, each layer consisting of one or more pieces. There are 52 smaller pieces on top provided with handles for easy handling. These weigh in all about 3,100 pounds. By adding or removing some or all of these smaller weights the counterweight can be readily increased or diminished. The total amount of lead counterweight furnished with the carriage is 74 pieces, weighing approximately 74,800 pounds, and forming a pile, including bottom of cage, 6 feet 3 inches high.

The amount of lead counterweight sent with each carriage is designed to be 1,000 or 1,500 pounds *in excess of that required to raise the gun to the firing position* under normal conditions. No matter what charge be used the counterweight used should be such as will raise the gun completely to the firing position in about seven seconds, but should never be such as to cause the top carriage to strike the counter-recoil stops with great shock. In its lowest position the counterweight hangs in an annular well formed in the concrete platform concentric with the base ring, 22 feet 2 inches inside diameter, 52 inches wide, and 73 inches in depth, measured from the underside of the exterior base ring. Access to the bottom of the pit is obtained by means of a ladder and trapdoor in the platform.

ELEVATING ARM AND RACK.

The elevating arm of cast steel has two bronze-bushed bearings at its lower end which are connected to a rack of circular shape by means of the elevating rack shaft. The upper ends are open and provided with capped bronze boxes, which fit over the trunnions on the elevating band. The inside diameter of the elevating band for the gun of the model of 1888 is 38.5 inches, and that for the model of 1895 is 37 inches.

The elevating rack is moved in inclined circular guides bolted on the rear face of the rear transom by the elevating gearing system. The guides allow it the movement necessary to change the elevation

of the gun from 5° depression to 12° elevation. There is provided a removable stop, to be placed in tapped holes in the left side of the rack, limiting the depression to either 0 or 5° , as may be required by the parapet over which the gun is to be fired, and two leaf springs attached to lower edge of the transom, acting as buffers to prevent shocks to the system should the gun reach its limit of elevation with too great velocity. A stop on the lower end of the right guide limits the elevation to 12.5° .

In this carriage, the gun when recoiled to the fifteenth notch always returns to the same loading angle, whatever may be the firing angle, as the elevating rack and its guideways are circular and struck with radii from the center of the trunnions on the elevating band when the gun is in the loading position.

ELEVATION SCALE AND POINTER.

The elevating pinion shaft, projecting through the chassis rails, carries at each end an elevation disk, to the circumference of which is attached a brass strip graduated to minutes of elevation on one disk. and to be graduated to range on the other. On account of the character of the motion the distance between the degree marks on the elevation disk is not constant, thus requiring the scale to be graduated by the use of a clinometer, supported by a rest placed in the muzzle of the gun, after the gun is mounted upon the carriage, at the time of the shop test.

An elevation pointer, in smooth contact with the graduation disk, is screwed to each chassis rail. These pointers have oblong holes to permit motion for any needed adjustment, after which they are to be fixed in position by two dowels.

ELEVATING SYSTEM.

For pointing in elevation two handwheels are provided, one on each side of the carriage, to be operated by two men standing on the platform. These handwheels actuate, through a train of bevel and worm gearing, a forged-steel elevating pinion, which engaged the bronze elevating rack constrained in circular guides bolted to the rear face of the rear transom.

The worm wheel of the elevating gearing is mounted loosely on the elevating shaft which carries the elevation disks, but bears against a thrust collar. The inside of the rim of the worm wheel is coned, and in contact with it is a coned friction clamp constrained by two keys to rotate with the shaft but capable of motion along its axis. By means of two nuts on the shaft the friction wheel may be forced against the worm wheel, so that the necessary amount of friction may be obtained.

The nuts for adjusting the friction should be set up just sufficiently to prevent the elevating rack from running down due to the weight of the elevating rack, arm, band, and breech preponderance of the loaded gun. By this means any dangerous strains to the elevating mechanism incident to firing are relieved.

TRAVERSING SYSTEM, RETRACTING SYSTEM.

For pointing the carriage in azimuth and for hauling down the gun the two systems have been combined. To a horizontal shaft in front of the carriage are attached two crank handles, to be operated by two men for traversing and six men for retracting. This shaft actuates a train of bevel gearing and a bronze spur pinion which engages a traversing rack of forged steel made in thirteen sections and bolted to the inside of the outer base ring. By means of a clutch operated by a lever on the right side of the carriage at the front the traversing system may be thrown out of gear and the retracting system in gear.

The retraction is accomplished through a train of bevel and spur gears by means of two wire ropes wound upon cast-iron drums and fastened thereto by corrugated clamps. From the drums these ropes pass around guide pulleys in rear of the recoil buffers and are hooked to the upper ends of the gun levers. These ropes remain with the carriage, and when not in use are wound upon the drums until the ends project but a short distance from the guide pulley brackets. For rapid and easy overhauling of the ropes a small handwheel is fixed to the intermediate retraction shaft. To save time, this handwheel should also be used to wind up the slack of the ropes before placing the crank handles on the shaft. In hauling down, care should be exercised that each rope is under *equal tension*. After taking up the slack in the ropes and putting some strain on them, they should be vibrated slightly, and if found to be unequally loaded, adjustment should be made at the rope clamps on the drums. After the loop of the rope is placed over the hook on the gun levers and while winding up the slack especial care should be taken that the rope is guided to the pulleys without any kinks or any slack and that the coils lie smoothly upon the drums without crossing the ridges between the grooves.

SIGHTING STANDARD AND PLATFORMS.

A standard is provided screwed into the left piston-rod bracket over the rear end of the chassis, to carry the telescopic sight holder and afford sufficient vertical adjustment so that the telescope may be placed at a convenient height, or as low as the height of any parapet may permit. Counter set screws and adjusting collar will be pro-

vided for making a slight adjustment in rotation and fixing the standard, with the line of the collimation of the telescope in a vertical plane parallel to a vertical plane through the axis of gun.

A sighting platform is provided behind the standard whereon the gunner stands when directing the aiming of the piece. This platform is located at such a height as will enable him to see the field of fire over the crest of the parapet. It is reached by means of a vertical ladder secured to the underside of the platform proper and stiffened by braces extending to the rear of the chassis, is surrounded on three sides by a hand rail of 1-inch pipe, and is provided with a wire screen on the side nearest the gun to protect the gunner from the gun lever arms during recoil.

To give access to the telescopic sight when placed in the right gun trunnion, a trunnion-sighting platform is provided. This is secured to the top carriage and is made accessible by a short ladder, likewise attached to the top carriage.

WORKING PLATFORM.

A working platform, made up of steel plates and supported by angles and beams, extends over the racers at the same height as the concrete working platform.

A trapdoor and ladder is provided, on the left rear side, for entering the counterweight wells.

AMMUNITION TRUCKS, SHOT TONGS, ETC.

The ammunition is served to the gun on an ammunition truck, three being furnished for each carriage. The projectile tray is so arranged that the projectile can be easily raised to the proper height for loading, and may also be given practically the same angle that the gun has in the loading position. The truck is run up to the breech of the piece until it stops against the face plate, insuring stability during ramming. The frame of the truck is built up mainly of angle irons, riveted. The short tray and cartridge shelves are steel plate rolled into shape. The truck is supported by four wheels, all of which are rubber tired. It is provided with a brake for the two front wheels, this brake being operated by a foot pedal arranged conveniently with respect to the truck handles. A crank is provided at the left side of the truck, the operation of which usually serves to raise the shot pan as a whole without changing its inclination with respect to the horizontal. Ball bearings are provided for the elevating screw and for the casters.

Each carriage is provided with seven shot tongs for the handling of the projectiles. The tongs are made of forged steel, riveted and bolted together. In order to provide tongs having the least possible height over all, they are designed to use a locking link which must be oper-

ated to hold the arms in position on the projectile, and with a gripping dog or eyepiece, the inner toe of which is pressed against the top of the projectile by the upward pull in the eye, thus preventing the projectile from slipping out endwise if not properly balanced.

GENERAL REMARKS.

An elevating band, for the gun to be mounted, and the necessary tools and implements are furnished with each carriage. The pinch bars and retracting cranks are placed on hooks on the sides of the chassis rails, and implements for the gun and carriage and the tools are neatly packed in an armament box marked with the number of the carriage, etc., to the inside of the lid of which is affixed a list of the contents.

There are plates on the carriage indicating the direction of motion of the elevating handwheels and of the traversing and retracting cranks, also instruction plates for filling, etc.

Drainage holes are drilled in all pockets, and all axles, bearings, and sliding-bearing surfaces are provided with oil holes, closed by screw plugs. The six main axle bearings, trunnion beds, gun-lever axle, and crosshead pin bearings are supplied with compression grease cups. These cups, by means of a spring-actuated cup leather plunger, automatically force the lubricant through the passages and distributing grooves under the surfaces.

ASSEMBLING THE CARRIAGE.

IMPLEMENTS.

The assembling requires machines and implements for mechanical maneuvers usually found at forts; but in addition to falls, blocking, jacks, sling chains, etc., a derrick capable of lifting 8 tons, with a boom 35 feet long, will be found especially useful.

GENERAL REMARKS.

The size and weight of the carriage permit it to be transported by rail partially assembled.

In assembling the carriage, as in all machinery, no parts should be directly struck with a steel hammer or sledge. Soft metal drifts or copper or lead hammers should be used.

In unloading or handling the parts care should be exercised that the edges or finished surfaces do not become upset or burred. When two bearing surfaces are brought together it is especially necessary that both parts should be absolutely clean, smooth, and well lubricated.

The following description gives a statement of the order in which the parts should be put together, rather than a complete enumeration of the details of the operation:

BASE RINGS, LEVELING.

Lower or skid the inner base ring over its proper position on the platform, and let it down so that the bolts shall enter the holes centrally. Before reaching a bearing put the thrust plates under the leveling screws. *A sensitive machinist's level and accurate steel straightedges should be used in leveling.*

When necessary, straightedges of special form are made for this purpose. The threads of the platform bolts, freed from rust, should be carefully examined to see whether they have been burred in the operation of lowering. After they have been put in good order, thoroughly oil the threads of the bolts and the bearing surface of the nuts before screwing on the nuts. In screwing down the nuts take up on each a little at a time, so that the base ring shall not be unnecessarily strained. The greatest care must be exercised in using the "level" and "straightedge" that the middle of the level is equidistant from the points of contact of the straightedge with the surfaces being leveled, and that these points of contact on the straightedge are equidistant from either end. In using the level it should always be reversed, and the mean of the readings in the two positions considered the true reading. The preliminary leveling may be done from the top of the pintle. Finally, radially outside of bolts, place the straightedge on the turned surface of the roller path, which supports the dust guards and follow around circumferentially each way, on this surface, leveling and tightening the foundation bolts until no high spots are found, and the nuts are screwed down. Next, proceed to level the ring radially, using the "leveling gauge" furnished, on the conical roller path. Then again level around circumferentially on the top surface, and caliper the outside of the pintle. If the pintle shows more than 0.01 inch ellipticity, the ring has been strained, and the foundation bolts must be loosened and the whole operation repeated until the ring is true and level. After the base ring has been properly leveled and secured, pour under it, through the holes under the roller path, a grouting of neat Portland cement. After the grouting under the base ring has set firmly, the leveling screws should be unscrewed slightly to prevent their being strained in firing. Next put the sections of the outer base ring in place, and fasten them together with the bolts and keys supplied for this purpose. The sections are blocked up over their positions on the platform during this process. Chip out places in the concrete for the under flanges, and lower to a bearing, as in the case of the inner base ring, first locating the thrust plates properly.

Use the inner base ring (after the grouting is thoroughly set) as a support, and jack out the near points of the outer base ring until the two are concentric. Level by using the special straightedge or leveling gauge furnished, which at the same time fixes the outer base ring

at the proper height above the inner one. Finish with grouting under the outer base ring, as in the case of the inner base ring. *The greatest care must be taken in leveling and setting the base rings, as the proper working of the carriage depends on the accuracy of this work.*

DISTANCE RINGS AND TRAVERSING ROLLERS.

Clean the roller paths, rollers, pintle surfaces, and distance rings, and place the rollers and distance rings in position. See that the joints and fishplates are free from burrs; also the bolts and nuts. After assembling, the roller system should be run around several times by hand to see that it works freely, that the rollers do not bind in their bearings in the distance rings, and that their flanges do not bind on the inner edges of the roller paths.

RACERS.

Thoroughly clean the pintle bearing and roller path of the inner racer and lower it into place, taking care to prevent the pintle surfaces from jamming. Put the dust guard in place, and see that the bearing surfaces are kept clean during the further progress of the work.

Clean the sections of the outer racer, block them up over their positions on the rollers, and bolt and key them together. Then lower carefully to a bearing on the rollers. Attach the traversing rack. The racers should then be run around by hand several times to see that they are entirely free in action.

CHASSIS AND TRANSOMS.

The two chassis, with transoms in place, are then moved over the racers, being still secured to the cradle and iron plates used for shipment of this carriage. These are then removed, and after the bearing parts have been cleaned and oiled the chassis and attached parts are lowered into position.

There are four taper dowels provided for adjusting the chassis to their proper bearings on the racers, one for each of the front and middle bearings. After adjusting the chassis as nearly as may be by using the dowel holes as guides, drive the dowels home, and then proceed to bolt and key the chassis securely in place, first loosening the transom bolts to just pinch, and relieving strains.

All of these bolts should be tightened, just to pinch, after which tighten each in succession a little until all are under a sufficient initial tension not to work loose.

Assemble the floor beams to the racers and attach the sections of the exterior dust guard to the brackets and the brackets to the outer base ring. Assemble the floor plates.

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TRAVERSING GEAR.

After assembling the traversing gearing and clips, traverse several times around to see that there is still no binding of rollers and that they are evenly loaded, then place the carriage successively at four points 90° apart and at each carefully note that crosshead guides are vertical in both directions, that chassis rails are level across and of the designated slope.

Any variations found by these tests indicate imperfect setting of the base rings, which should be carefully examined and remedied—or *else imperfect work on the carriage.*

RECOIL ROLLERS AND TOP CARRIAGE.

The recoil rollers and their paths should be thoroughly cleaned, any burrs removed, and oiled before top carriage is put in position. After top carriage is placed it should be run forward and backward on the rollers to see that it works entirely free and that all rollers bear evenly at all points of recoil.

The top carriage will usually be received with piston rods assembled, stuffing boxes packed, and cylinders filled with oil, *but should usually be dismounted for examination, necessitating reassembling and repacking.* See "Care of carriage, general instructions."

COUNTERWEIGHTS, CROSSHEAD, AND GUN LEVERS.

To assemble the gun on this carriage, the gun is brought over the parapet and mounted either from the front, in which case the counterweights are assembled in battery position, or from the rear, in which case the counterweights are assembled in their highest position. If mounted in battery position the top carriage should be against the counter recoil stops.

In any case, block up the bottom plate securely and level at the desired height. After the counterweight has been piled, raise the crosshead (assembled with the suspension rods) and lower the suspension rods through the holes, engaging the crosshead clips over the guides, being careful not to jam the brass liners. The threads of the suspension rods should be well wrapped with twine to prevent the lead from adhering to them in lowering. The suspension-rod nuts should now be screwed on and adjusted to a bearing at equal distances from the ends of the rods. *It is of great importance that each suspension rod should bear but half of the weight, and the nuts must be carefully adjusted to bring this about.* The gun levers can now be raised and assembled to the crosshead and top carriage, first being careful to clean the bearings and remove all burrs and to lubricate well.

If the gun is to be mounted with the levers up, the entire counterweight should be assembled first, to prevent the possibility of move-

ment when the gun is lowered into its trunnion beds. If the gun is to be mounted in the loading position, the small counterweights may be left off, and after the gun has been mounted enough of the small weights should be added to make the crosshead settle down against the pawls.

ELEVATING BAND.

Place the elevating band on the gun and adjust it so that the centers of its journals shall be 84 inches from the centers of the trunnions of the gun. Measure on both sides and carefully inspect by striding level or otherwise to see that the line joining the centers of the journals is in a horizontal plane. This should never be done except under the supervision of the Ordnance Department. Ground emery and oil should be placed between the band and the gun to make the band grip well. Set up the gripping bolts as tight as possible, after which the set screws, already set into the gun, should be set up to bottom.

GUN.

Carefully clean and lubricate the trunnions of the gun and the trunnion beds with No. 4½ grease, after which mount the gun and secure the muzzle by ropes to prevent rotation.

In blocking up for mounting the gun use long bearings and be careful to see that no excessive weight is localized on the floor plates.

If it should ever be necessary to raise or lower the counterweight when the gun is not mounted, it must be done carefully by means of jacks and blocking. The cylinders can not be used as buffers to check the fall of the counterweight except when the gun is mounted.

ELEVATING ARM.

Assemble the lower ends of the elevating arm to the elevating rack and raise the upper ends to position on the band, insert the forward bronze boxes and the steel caps, and screw home the nuts.

In assembling the elevating arm it should be noted that it does not bind the band trunnions through any inaccuracy.

GEARINGS.

Most of the parts of the gearing on this carriage are shipped in assembled position. These should be thoroughly cleaned and all bearings lubricated, after which those parts which are shipped separately should be assembled.

PLATFORM.

Sighting platforms, ladders, sight standard, and other smaller parts and appendages can now be assembled.

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AFTER ASSEMBLING.

When the carriage is completely assembled and the cylinders are filled with oil, carefully inspect it to see that nothing is overlooked, after which the gun should be allowed to run into battery several times to see that everything works properly. Always detach the retracting ropes from the gun levers immediately after retracting. Again inspect and tighten any parts which may have become loosened.

SPECIAL POINTS TO BE NOTED.

After the carriage has been completely assembled and the gun mounted, the following points should be noted, viz:

1. Traverse the carriage around, and elevate and depress gun to see that they move freely.
2. Examine and clean out all oil holes, noting that they have oil plugs.
3. See that there is not a hard bearing between the rim bases of the gun and gun levers.
4. See that the elevating arm and band are properly assembled, the clearances on each side being the same, and the arm not sprung or twisted.
5. See that the chassis rails and crosshead guides have not been burred.
6. See that the retraction ropes are properly adjusted, follow the grooves on the drums, and are not twisted.
7. See that the dust guards do not bear against the distance rings or base ring.
8. Adjust counterweight until gun rises as promptly as possible into battery without striking the stops with violence, and noting that the counter-recoil buffers act efficiently.
9. See that the piston rods are parallel to the tops of the chassis rails and also to their inside edges.
10. See that the stops to limit the motion in depression are properly placed to suit the particular emplacement.
11. See that the pawls engage simultaneously on each rack of the crosshead and that the tripping and safety tripping devices function properly.
12. Set the elevation pointer by the use of a clinometer supported by a rest in the muzzle of the gun and dowel-pin it in position.
13. Orient the gun, add numbers to the degree marks on azimuth circle, and adjust the azimuth pointer to indicate correct azimuth, and dowel-pin it in position. Muzzle at true south is 0 degree in azimuth and numbers are placed around clockwise to include 359.
14. Adjust the sight standard, by means of the counter set screws, so that an accurate telescope placed in the sight holder will sight on

the same distant point that it will when placed in the trunnion sight bracket or that is covered by the bore sight.

CARE OF THE CARRIAGE; GENERAL INSTRUCTIONS.

Carriages should be traversed from time to time throughout their entire allowed movement. They should not be allowed to stand for long periods set at a particular azimuth, as this might cause uneven settlement of the platforms.

* The habitual position of guns on disappearing carriages is "from battery," but at intervals the gun should be allowed to rise to the firing position and be elevated and depressed within the limits of the stops.

It is especially required that all parts of carriages be kept free from rust at all times. If this be allowed to accumulate, its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, and emery cloth No. 1, being coarse enough for any ordinary rusting, should be used, the rust being softened, if necessary, by kerosene.

The retracting wire ropes should at all times be kept well oiled with raw linseed oil.

If any leakage occurs from the hydraulic recoil system it should be immediately remedied, calling, if necessary, upon the district armament officer for the services of skilled labor.

The repacking of stuffing boxes may be done, when necessary, by trained enlisted men under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition, and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months, and thoroughly cleaned every six months.

INSTRUCTIONS FOR CLEANING RECOIL CYLINDERS.

For this cleaning a plumber's hand force pump will be supplied to east coast artillery post, with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that in no case will it be necessary to remove the packing from a stuffing box to clean the cylinders.

In cleaning, the following order of operations may be followed:

(a) Run gun into battery and remove oil from hydraulic recoil system.

(b) Retract gun until pistons are in the middle of the cylinders; then slack away until the pawls engage in the ratchet teeth on the crosshead. Observe that the pawls are properly engaged in the ratchet teeth and that the pistons are not under the filling holes.

(c) Remove the piston-rod brackets from the rear ends of the chassis rails. Take off the two nuts on the front end of each piston rod, remove the rear cylinder head from each cylinder, and carefully remove the rods rearward out of the cylinders. Before removing any part it should be marked, so as to insure its being assembled in its correct position.

(d) Thoroughly clean each cylinder from both ends with kerosene oil forced in with a hand pump, then wipe dry with clean cotton waste. Clean the piston rods and stuffing boxes. The equalizing and connecting pipes should be dismantled and thoroughly cleaned by forcing kerosene oil into them with the pump.

(e) Assemble the equalizing and connecting pipes, leaving the throttling valve wide open. Insert each piston rod in its cylinder, exercising great care that it be neither bent nor damaged in any way, and that the piston does not bind in or burr the walls of the cylinder. Assemble the two nuts on the front end of each rod. Place each rear cylinder head on its rod and move it forward into its seat in the cylinder. Assemble the piston rod brackets to the chassis and then firmly secure the rear cylinder heads to the cylinders. Properly tighten the four followers of the stuffing boxes and fill the recoil cylinders with hydroline oil. This will require some time, as the oil can enter the parts of the cylinders in rear of the pistons only through the equalizing pipes and the throttling-bar orifices. When apparently filled, insert the filling plugs, close the throttling valve, and retract the gun to the loading position. Complete the filling of the cylinders and close the throttling valve to its proper setting.

Carefully inspect all parts dismantled and note that they have been properly assembled. Then trip the pawls and let the gun rise into battery.

The piston-rod nuts should then be loosened to insure the rod being centrally located in the cylinder and the nuts finally tightened.

The gun should be retracted and tripped several times to insure that all parts are in proper working order.

TO REMOVE PACKING FROM A STUFFING BOX.

Close the extractor around the piston and insert the locking pin. When the needles or hooks are in contact with the packing, turn the extractor to the *left*, pressing lightly downward at the same time until the needles are firmly engaged in the packing. Then pull back on

the handles of the extractor, still turning slowly to the *left* until the packing reaches the threads of the stuffing box, when, unless the packing is quite loose, its further removal should be accomplished by unscrewing, and so following the thread. It should be noted that the packing has been set hard against the walls of the stuffing box and the piston rod, and it will catch on the threads of the former, so that unless removed by unscrewing, as described, the packing is likely to be injured.

Extracting bars are provided, to be used for starting the packing from its seat, and steps are formed on the exterior in which the toes of the bars can engage.

TO PACK OR REPACK A STUFFING BOX.

Examine the old packing and discard all unfit for use. If any of the old packing is used, it should be put in after the new. See that the stuffing boxes are well cleaned and slightly oiled.

Put on the piston rod one ring of 0.75-inch Garlock's "waterproof hydraulic" packing, and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of packing in a similar manner, being careful to break joints until six rings of new packing have been inserted in rear boxes and seven rings in front boxes, or an equal amount of new and old when any of the latter is used. Place the halves of the gland on the follower, enter them together in the box, and screw up the follower, being careful to note that the halves of the gland do not bind on the screw threads.

No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of a pipe to the end of the spanner wrench should not be permitted.

When the box is properly filled and the follower tightened, there should not be more than 1 inch of space between the flange of the follower and the piece into which the follower is screwed. The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the piston rod. When the follower is screwed in until the flange strikes the box another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes of carriages when not in use. Also when tightening the followers a slight amount of oil will squeeze out of the saturated packing. This oil should be caught in the drip pan and not allowed to render the carriage unsightly.

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SERVICE CONDITION. (Lubrication, etc.)

When the carriage is to be kept in readiness for service and is in daily or frequent use, all bearing parts must be kept thoroughly cleaned and lubricated. Especial attention should be given to the lubricating of trunnion beds, rollers, pintle surfaces, shaft axle bearings, and sliding surfaces, gun-lever axle beds, crosshead pins, elevating rack, elevating-band trunnions, crosshead guides, and the elevating, traversing, tripping, and retracting mechanisms, including the teeth of all gears.

The above parts should be lubricated at frequent intervals, whether the carriage is maneuvered or not. When carriages are in use for daily drills a thorough lubrication twice each week should be sufficient.

It will occasionally be necessary to examine all ball and roller bearings, to see that the dust guards are in proper place and that the rollers themselves are clean.

OIL HOLES.

Oil holes, where provided, must be cleaned out frequently to keep them free from sand and grit, and will habitually be kept closed by the screw plugs provided, except when in the act of oiling.

Before oiling at any oil hole, wipe off carefully any dirt or grit near the opening that might be carried down into the bearing by the oil.

COMPRESSION GREASE CUPS.

Where compression grease cups are provided, similar precautions against dirt or grit must be observed. In filling these cups, do not fill the cup completely, but fill only to the bottom of the bevel at the top of the cup; if too full, the leather packing will become inverted and will not act effectively. In putting on the cap, see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup or otherwise. Screw the cap down on the cup, using a wrench, if necessary to secure sufficient power, until the spring rod projects about 0.25 inch above the top of the cap. Later, when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearings, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the spring rod does not project, it is an indication that the cup should be refilled.

For further information regarding paints, oils, cleaning materials and methods of using same, see Ordnance Department Pamphlet, Form 1869. Annual allowances will also be found in this pamphlet.

[No. 1693]

LIST OF ARTICLES PACKED IN ARMAMENT CHEST FOR 10-INCH RIFLE, MODEL OF 1888,
MOUNTED ON DISAPPEARING CARRIAGE, A. R. F., MODEL OF 1896.

[Articles marked * are carried loose in the chest.]

1 screw driver for breech plate screw.
3 screw drivers for breech mechanism screws.
1 tool for crank catch.
1 obturator spindle nut wrench.^a
1 obturator nut clamp-screw wrench.
1 pin punch.
1 tit wrench for obturating spindle.
1 pressure plug wrench.
1 ring for lifting breech plate.
2 bronze drifts.
1 gunner's punch.
1 gunner's drill.
1 gunner's pouch.
1 gunner's sleeves (1 pair).
1 gunner's lanyard.
1 metal scraper.
*10 pounds waste, cotton.
*4 balls twine, assorted.
*2 pounds copper wire, No. 12.
*2 pounds copper wire, No. 16.
1 quire emery cloth, No. 00.

*3 wagon sponges.
1 file, flat, dead smooth, 8-inch.
1 file, round, second cut, 8-inch.
1 file, half round, smooth, 8-inch.
1 file, three-cornered, 8-inch.
1 copper hammer.
1 boiler maker's hammer.
1 hand mallet.
1 long-handled mallet.
1 cutting pliers.
1 monkey wrench, 18-inch.
1 monkey wrench, 12-inch.
*1 box for firing mechanism.
In firing mechanism box:
3 cleaning brushes for primer seat.
1 cleaning reamer for primer seat.
To be used on bruised breechblocks, no other files to be used thereon:
3 files, pillar No. 6, 6-inch.
3 files, three-cornered No. 4, 6-inch.
3 files, half-round, smooth, 8-inch.
3 files, round, smooth, 8-inch.

LIST OF ARTICLES PACKED IN ARMAMENT CHEST FOR 10-INCH RIFLE, MODEL OF 1896,
MOUNTED ON DISAPPEARING CARRIAGE, A. R. F., MODEL OF 1896.

1 screw driver, commercial, for breech-mechanism screws.
1 obturator spindle-nut wrench.
1 obturator nut clamp-screw wrench.
1 pin punch.
1 tit wrench for obturating spindle.
1 pressure-plug wrench.
2 bronze drifts.
1 gunner's punch.
1 gunner's drill.
1 gunner's pouch.
1 gunner's sleeves (1 pair).
1 gunner's lanyard.
1 metal scraper.
*10 pounds waste, cotton.
*4 balls twine, assorted.
*2 pounds copper wire, No. 12.
*2 pounds copper wire, No. 16.
1 quire emery cloth, No. 00.
*3 wagon sponges.
1 file, flat, dead smooth, 8-inch.

1 file, round, second cut, 8-inch.
1 file, half round, smooth, 8-inch.
1 file, three-cornered, 8-inch.
1 copper hammer.
1 boiler maker's hammer.
1 hand mallet.
1 cutting pliers.
1 monkey wrench, 18-inch.
1 monkey wrench, 12-inch.
1 long-handled mallet.
*1 box for firing mechanism.
In firing mechanism box:
3 cleaning brushes for primer seat.
1 cleaning reamer for primer seat.
To be used on bruised breechblocks, no other files to be used thereon:
3 files, pillar No. 6, 6-inch.
3 files, three-cornered, No. 4, 6-inch.
3 files, half-round, smooth, 8-inch.
3 files, round, smooth, 8-inch.

^a No. 1 for guns Nos. 2 to 20, inclusive. No. 2 for guns after No. 20.

LIST OF ARTICLES PACKED IN ARMAMENT CHEST FOR 10-INCH DISAPPEARING CARRIAGE,
A. R. F., MODEL OF 1896.

1 extractor for gun lever and suspension rod pins.	1 wrench for cylinder head.
4 lifting hooks (for floor plates).	*1 locomotive oiler (1 quart).
2 counterweight hooks.	1 double wrench for $\frac{1}{2}$ -inch and $\frac{3}{4}$ -inch nuts.
2 cylinder-head extractors.	1 double wrench for 1-inch and $1\frac{1}{4}$ -inch nuts.
1 foundation-bolt wrench.	1 single wrench for $1\frac{1}{4}$ -inch nuts.
2 foundation-bolt wrench handle.	1 single wrench for 2-inch nuts.
1 box wrench for filling plugs.	2 water buckets, indurated fiber (not in armament chest).
1 screw driver, steel.	2 pinch bars (not in armament chest).
1 screw driver, commercial.	2 oilers (half pint).
2 wrenches for piston-rod nuts and elevating friction nuts.	
1 spanner wrench for stuffing boxes.	

LIST OF IMPLEMENTS FURNISHED WITH EACH 10-INCH RIFLE OF MODELS OF 1893 AND 1895.

1 rammer and staff.	1 sponge cover, chamber.
1 sponge and staff, bore.	1 slush brush with handles to connect with special sponge staff.
1 sponge and staff, chamber.	1 steel scraper and socket to fit special sponge staff.
1 sponge and rammer prop.	1 special sponge staff for slush brush and steel scraper.
1 breech cover.	
1 combined tompon and muzzle cover.	
1 sponge cover, bore.	

LIST OF EQUIPMENT SUPPLIED FOR EACH 10-INCH RIFLE OF MODELS 1888 OR 1895 AND 10-INCH DISAPPEARING CARRIAGE, A. R. F., MODEL OF 1896.

2 paint pots, 1 gallon.	3 sash tools, No. 6. ^a
1 sieve for paints and oils.	3 brushes, paint, 6/0. ^a
2 brushes, wall, 4-inch. ^a	2 dusters, painter's, No. 2. ^a

GASKETS AND PACKING.

1 set gaskets for carriage.	4 rings Garlock's waterproof hydraulic packing, 0.25 square and 1 inside diameter.
22 rings Garlock's waterproof hydraulic packing, 0.75 square and 3.5 inside diameter.	

^aExpendable.

[No. 1893]

Weight of principal parts 10-inch disappearing carriage, A. R. F., model of 1896.

Name of part.	Weight.	Name of part.	Weight.
	<i>Pounds.</i>		<i>Pounds.</i>
Chassis, transoms, top carriage, piston rods, and assembled gearing.....	43,900	Crosshead.....	4,900
Exterior base ring.....	23,850	Gun levers (2).....	9,225
Exterior racer.....	9,150	Gun-lever axle.....	1,250
Interior base ring.....	10,350	Top carriage.....	10,371
Interior racer.....	9,100	Recoil rollers with frames (2 sets).....	1,721
Exterior distance rings, complete.....	2,415	Piston and rods (2).....	1,240
Interior distance rings, complete.....	1,035	Elevating band.....	800
Exterior rollers (48).....	2,304	Elevating arm.....	1,840
Interior rollers (24).....	2,952	Elevating rack.....	1,425
Floor ring with fastenings.....	3,090	Implements.....	360
Floor plates with fastenings.....	5,820	Total weight of carriage.....	216,211
Bottom plate with lead filling.....	5,085	Weight of three ammunition trucks.....	1,660
Lead weights.....	74,800		
Suspension rods (2).....	825	Total weight.....	445,679

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, with their location and the material of which they are made.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Azimuth circle.....	On dust-guard angle.	Brass.....	1	In.	In.		In 12 sections.
Azimuth pointer.....	On exterior racer..	do.....	1				With 2 dowel pins, $\frac{1}{4}$ inch in diameter.
Azimuth pointer lid.....	do.....	Bronze.....	1				With hinge and hinge pin.
Azimuth circle braces.	On exterior base ring.	Wrought iron...	32				
Base ring (inner).....	On platform.....	Cast-iron, No. 2.	1				
Base ring (exterior).....	do.....	do.....	1				In 8 sections.
Ball-bearing washers.....	Elevating-worm shaft.	Hardened steel..	2				Top and bottom parts.
Ball-bearing balls.....	Between washers..	do.....	18	0.5			
Ball-bearing cover.....	Over ball-bearing washer.	Bronze.....	1				
Beam (I).....	On racers.....	Steel.....	1				Floor-plate support.
Bolts (hexagonal head).	Traversing-shaft bracket	Wrought iron...	3	1.0	2.75		
Do.....	Retraction-gear bracket.	do.....	4	1.0	2.75		
Do.....	Vertical-shaft bracket.	do.....	2	1.0	2.75		
Do.....	Clutch bracket.....	do.....	4	1.0	2.75		
Do.....	Retraction drum-shaft collar.	Steel.....	1	.75	1.75		Set screw.
Do.....	Clutch-lever guide..	Wrought iron...	4	.5	1.5		
Do.....	Retraction-rope fastener.	do.....	2	.75	2.0		
Do.....	do.....	do.....	2	.75	1.8		
Do.....	Retraction hand wheel.	Steel.....	1	.75	1.75		Do.
Do.....	Base-ring joint.....	Wrought iron...	56	1.5	5.75	56	
Do.....	Racer joints.....	do.....	12	1.0	4.75	12	
Do.....	do.....	do.....	24	1.0	4.25	24	
Do.....	Distance rings (exterior).	do.....	48	.75	2.25		
Do.....	Racer clip to racer..	do.....	4	1.5	3.5		
Do.....	Azimuth-circle brace.	do.....	64	.75	1.5		
Do.....	Dust guard.....	do.....	128	.5	.5		
Do.....	Angle iron.....	do.....	64	.5	.75		
Do.....	Leveling screws.....	Bronze, No. 3....	16	2.0	2.75		
Do.....	Distance rings.....	Wrought iron...	20	.75	2.25		
Do.....	Dust guard to racer.	do.....	8	.5	.75		
Do.....	Leveling screws.....	Bronze, No. 3....	12	2.0	3.25		
Do.....	Suspension-rod nuts.	Wrought iron...	8	.75	4.0		
Do.....	Handle on gun lever	do.....	2	.75	1.5		
Do.....	Chassis to racer.....	do.....	50	1.5	4.5		
Do.....	Equalizing-pipe straps.	do.....	6	.5	.75		

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Bolts (hexagonal head).	Throttling bars.....	Wrought iron...	38	In. 1.0	In. 3.35	...	Fitted bolts, special.
Do.....	do.....	do.....	2	1.0	4.1	...	Do.
Do.....	Buffer to chassis.	do.....	4	2.0	11.25	4	
Do.....	do.....	do.....	8	1.5	10.25	8	
Do.....	Piston-rod brackets.	do.....	4	1.25	3.5	...	
Do.....	Sight-standard caps.	do.....	8	.5	2.0	...	
Do.....	Retraction-rope guard.	do.....	8	.5	.75	...	
Do.....	Rear transom.	do.....	24	1.25	3.5	...	
Do.....	Front transom.	do.....	14	1.25	3.25	...	
Do.....	Retraction-shaft bracket.	do.....	4	1.25	3.25	...	
Do.....	Worm-wheel casing.	do.....	2	1.25	3.0	...	
Do.....	do.....	do.....	2	1.25	4.75	...	
Do.....	Worm-wheel shaft cap.	do.....	2	1.25	4.25	...	
Do.....	Elevating-shaft bracket.	do.....	3	.75	2.0	...	
Do.....	Elevating hand-wheel standard to racer.	do.....	8	1.0	2.75	...	
Do.....	Elevating hand-wheel standard joint.	do.....	8	1.0	2.0	...	
Do.....	Elevating hand-wheel shaft bearing.	do.....	4	1.0	3.75	...	
Do.....	Elevating hand-wheel standard cover.	do.....	4	1.25	3.5	...	
Do.....	do.....	do.....	4	1.0	3.0	...	
Do.....	Worm-shaft bushing.	Steel.....	2	.5	1.1	...	Set screw.
Do.....	Buffer-spring yoke.	Wrought iron...	4	.75	3.0	...	
Do.....	do.....	do.....	8	.75	1.75	...	
Do.....	Elevating band.	do.....	2	2.0	20.5	2	8 threads per inch.
Do.....	do.....	Steel.....	2	1.5	...	...	Set screw; special.
Do.....	Elevating rack.	do.....	1	1.0	3.25	...	Do.
Do.....	Tripping-lever rest.	Wrought iron...	4	.75	1.5	4	
Do.....	Tripping lever.	Steel.....	2	.75	1.0	...	Set screw.
Do.....	Sight-standard platform ladder and braces.	Wrought iron...	5	1.0	2.0	...	
Do.....	Tripping-shaft bracket.	do.....	4	1.0	2.75	...	
Do.....	Steps on left chassis.	do.....	2	1.0	2.25	...	
Do.....	Top-carriage platform ladder and braces.	do.....	4	.75	1.5	...	
Do.....	Steps on right chassis.	do.....	2	1.0	2.25	...	
Do.....	Joint bolts in framing for floor plates.	do.....	34	.75	1.65	34	
Do.....	Angle iron to chassis.	do.....	16	.5	1.1	...	
Do.....	Beams to inner racer.	do.....	10	.75	2.0	...	With cast-iron washers.
Do.....	Joint plates and angles to exterior racer.	do.....	42	.75	1.3	...	
Do.....	Ladder in pit.	do.....	4	.75	1.65	4	
Do.....	do.....	do.....	2	.75	2.25	2	Do.
Do.....	Gear Guards.	do.....	5	.5	1.0	...	
Do.....	Throttling valve to top carriage.	do.....	2	.75	3.6	...	
Bracket:							
Traversing shaft..	On exterior racer...	Cast iron.....	1	...	...	...
Vertical shaft.....	On right chassis....	do.....	1	...	...	...
Retraction gear....	do.....	do.....	1	
Clutch.....	do.....	do.....	1	
Piston rod.....	do.....	Cast steel, No. 1.	1	
Do.....	On left chassis....	do.....	1	

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Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Bracket—Continued.				<i>In.</i>	<i>In.</i>		
Retraction shaft...	Inside right chassis.	Cast steel, No. 1.	1				
Elevating shaft...	On worm-wheel casing.	Cast iron, N. 2.	1				
Buffers, recoil.....	On bracket on inside of chassis.	Balata and iron.	2				Complete.
Buffer, recoil:							
Bracket.....	Attached to chassis.	Cast steel, No. 1.	2				Right and left.
Plates.....	Recoil buffer.....	Wrought iron	10				
Caps.....	do.....	do.	2				
Cushions.....	do.....	Balata.	12				
Cap bolts.....	do.....	Steel	4	1.0	12.25	4	Four 0.25-inch stop pins under head; four 0.25 split pins.
Buffer springs.....	On rear transom...	Spring steel	2				5 leaves to each spring.
Buffer-spring yokes.....	do.....	Wrought iron	2				
Buffers, counter recoil.	Rear stuffing-box head.	Bronze.....	2				
Bushings.....	Traversing-shaft bracket.	do.....	2				2 sizes.
Do.....	Retraction-gear bracket.	do.....	2				Do.
Do.....	Vertical-shaft bracket.	do.....	1				
Do.....	Clutch bracket.....	do.....	1				
Do.....	Tripping-shaft bracket.	do.....	2				
Do.....	Gun levers, lower end.	do.....	2				
Do.....	Gun levers, upper end.	do.....	2				In halves.
Do.....	Right chassis.....	do.....	3				3 sizes.
Do.....	Left chassis.....	do.....	2				2 sizes.
Do.....	Top carriage trunnions.	do.....	2				In halves.
Do.....	Recoil-roller frame.	do.....	52				
Do.....	Elevating-shaft bracket.	do.....	1				
Do.....	Worm-wheel casing.	do.....	1				Threaded, 7 per inch.
Do.....	Worm-wheel shaft cap.	do.....	1				Half bushing.
Do.....	Rear transom.....	do.....	1				Do.
Do.....	Elevating hand-wheel standard.	do.....	4				
Do.....	do.....	do.....	6				In halves, 4 sizes.
Do.....	Elevating arm, lower end.	do.....	2				
Chassis.....	Bolted to racers	Cast iron.....	1				Right hand.
Do.....	do.....	do.....	1				Left hand.
Clutch.....	On clutch and retraction gear shaft.	Bronze.....	1				
Clutch trunnion.....	Clutch and clutch lever.	do.....	1				
Clutch lever.....	Clutch bracket.....	Forged steel	1				
Clutch-lever guide.....	Right chassis.....	Steel.....	1				
Clutch pinion.....	Clutch shaft.....	Bronze.....	1				
Clutch-lever fulcrum pin.	Clutch bracket.....	Steel.....	1				
Clutch shaft.....	Traversing and clutch brackets.	do.....	1				0.5 square key.
Collars.....	On clutch pinion.	Bronze.....	1				
Do.....	Clutch shaft.....	do.....	1				
Do.....	Traversing and retraction crank shaft.	do.....	1				
Do.....	Retraction drum shaft.	do.....	1				
Counterweight.....	Suspended from crosshead.	Lead.....	52				Beginning at the top first layer detachable.
Do.....	do.....	do.....	6				Second layer.

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Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Counterweight.....	Suspended from crosshead.	Lead.....	6	In.	In.		Third layer.
Do.....	do.....	do.....	1				Fourth layer.
Do.....	do.....	do.....	9				Fifth, sixth, seventh, eighth, ninth, tenth, eleventh, twelfth, and thirteenth layers.
Counterweight bottom plates.	do.....	Cast iron, No. 2.	1				Filled with lead.
Counterweight handles.	In detachable pieces.	Wrought iron.	52				
Counterweight hooks.	With carriage.	Steel.	2				
Covers.....	Exterior racer.	Sheet steel.	2				
Crosshead.	Between chassis.	Cast steel, No. 1.	1				
Crosshead liners.	In crosshead.	Tobin bronze.	16				
Crosshead-liner rivets.	Through narrow liners.	Brass.	26				
Direction plates.....	For elevation and depression, on chassis.	Bronze.	2				Right and left.
Do.....	For traversing, on chassis.	do.....	2				Do.
Do.....	For retraction, on chassis.	do.....	2				Do.
Direction plate for clutch lever.	On clutch-lever guide.	do.....	1				
Distance rings.....	For exterior traversing rollers.	Wrought iron.	2				Each ring in 4 segments.
Distance rings, fish plates.	Distance rings for exterior traversing rollers.	do.....	8				
Distance rings, separators.	do.....	Cast iron.	24				
Distance rings.....	For inner traversing rollers.	Wrought iron.	2				Each ring in 2 segments.
Distance rings, fish plates.	Distance rings for inner traversing rollers.	do.....	4				2 sizes.
Distance rings, separators.	do.....	Cast iron.	12				
Dowel pins.	Chassis to racers.	Steel.	4				
Dust guard.....	For exterior traversing rollers.	Steel plates.	1				In 10 sections, 2 sizes.
Dust-guard angle.....	Azimuth circle braces.	Steel.	1				In 10 sections.
Dust guard.....	For inner traversing rollers.	Steel plate.	1				
Do.....	Roller bearing for retraction drum shaft.	Steel.	1				Felt washers and 2 steel washers bored 3.05 inches.
Do.....	do.....	do.....	1				Felt washers and 2 steel washers bored 2.80 diameter.
Door.....	To pit.	do.....	1				With hinges.
Door latch.....	Door to pit.	do.....	1				
Elevating arm.....	Joining elevating rack and gun.	Cast steel, No. 1.	1				
Elevating-arm boxes.	Elevating arm, gun end.	Bronze.	2				In halves.
Elevating-arm caps.	On end of elevating arm.	Forged steel.	2				Gun end.
Elevating band.....	On gun, model of 1888.	Cast steel, No. 1.	1				For rifle, model of 1888, stamped on band.
Elevating-band set screw.	Trunnion of elevating band.	Steel.	2	1.25	10.0		For 10-inch rifle model of 1888.
Elevating band.....	On gun, model of 1895.	Cast steel, No. 1.	1				For rifle, model of 1895, stamped on band.
Elevating-band set screw.	Trunnion of elevating band.	Steel.	2	1.25	10.75		For 10-inch rifle model of 1895.

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Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Elevating-rack guides.	On rear transom...	Cast steel, No. 1.	2	In.	In.		Right and left.
Elevating rack.....	In elevating-rack guides.	Bronze, No. 1...	1				24 teeth, 2 pitch.
Elevating pinion.....	Engaging elevating rack.	Forged steel, No. 3.	1				21 teeth, 2 pitch, two 0.75-inch keys.
Elevating bevel pinion.	On elevating shaft.	Steel.....	1				17 teeth, 3 pitch, one 0.5-inch key.
Elevating bevel gear..	On worm shaft.....	Bronze, No. 3...	1				24 teeth, 3 pitch, one 0.5-inch key.
Elevating-arm shaft..	Connecting elevating arm and rack.	Forged steel, No. 3.	1				
Elevation disks.....	On worm-wheel shaft.	Cast iron.....	2				Two 0.5-inch square keys.
Elevation-disk bands.	Elevating disk.....	Brass.....	2				Graduated.
Elevation pointers....	On chassis.....	do.....	2				Two 0.25-inch dowel pins.
Elevating miter gears.	On hand wheel intermediary and elevating shafts.	Steel.....	8				13 teeth, 3 pitch, eight 0.5-inch square keys, 2 sizes.
Elevating worm and shaft.	Worm-wheel casing.	Forged steel, No. 3.	1				Right-hand single threads, 15 inches lead, in one piece.
Elevating worm wheel.	Elevating worm-wheel shaft.	Bronze, No. 3...	1				27 teeth, 1.5-inches circular pitch.
Elevating hand wheels.	Elevating hand-wheel shaft.	Wrought and cast iron.	2				Two 0.5-inch square keys.
Elevating hand-wheel shafts.	In standard.....	Steel.....	2				
Elevating worm-wheel cover.	Rear transom.....	Sheet iron.....	1				Five 0.25-inch rivets.
Elevating worm-wheel shaft.	Through chassis....	Forged steel, No. 3.	1			2	In 3 pieces, with 2 adjusting nuts and 2 brass couplings.
Elevating shaft.....	do.....	Steel.....	1				
Elevating-rack cover..	Rear transom.....	Sheet iron.....	1				
Elevating worm-wheel casing.	do.....	Cast iron, No. 2.	1				
Elevating intermediate shafts.	In standard.....	Steel.....	2				
Elevating standards.	Inner racer.....	Cast iron, No. 2.	2				Each in 2 parts.
Elevating-standard covers.	Elevating standard	do.....	2				
Elevating worm-wheel shaft cap.	Rear transom.....	Cast iron.....	1				
Extractor.....	For removing gun-lever pins.	Steel.....	1				
Do.....	For removing cylinder head.	do.....	2	0.75			
Floor plates.....	On and between racers.	do.....	1				21 pieces, part of them braced with angle irons.
Floor-plate supports.	On racers.....	do.....	15				Channel beams.
Do.....	On chassis and to floor plate.	do.....	8				Angles.
Floor-plate support brackets.	On racer and beams	do.....	36				
Floor ring.....	On platform.....	do.....	1				In 16 segments.
Floor-ring fastener strips.	Riveted to floor ring.	do.....	16				1/4-inch rivets.
Floor-ring angles.....	do.....	do.....	16				Do.
Floor-ring foundation irons.	In piers.....	do.....	16				Do.
Friction clamp.....	On worm-wheel shaft.	Cast steel.....	1				Two 0.75-inch keys.
Gear guard.....	For crank-shaft pinion.	Steel.....	1				
Do.....	For clutch pinion.	do.....	1				
Grease cup.....	Gun-lever axle and gun levers.	Bronze.....	6				
Grease-cup covers....	Grease cups.....	do.....	6				
Grease-cup pistons....	do.....	do.....	6				Nut and pin.
Grease-cup springs....	On piston.....	Steel.....	6				

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Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Grease-cup piston washer.	Screwed to piston..	Bronze.....	6	In.	In.		Leather washer and screw.
Gun levers.....	Carrying gun.....	Cast steel, No. 1.	2				Two 2 by 1.3-inch keys.
Gun-lever axle.....	Gun levers.....	Forged steel, No. 3.	1				
Gun-lever caps.....	Gun end of lever...	do.....	2				
Gun-lever handle.....	On right gun lever..	Wrought iron...	1				
Gun-lever eyebolts.....	In gun-lever caps...	do.....	2				
Gun-lever hooks.....	In gun end of lever..	do.....	2				
Gun-lever pins.....	In crosshead.....	Forged steel, No. 3.	2				
Implement box.....	With carriage.....	Ash.....	1				With lock and handles.
Keys.....	In exterior base ring.	Steel.....	8				1 by 2 inch keys.
Do.....	In exterior racer...	do.....	6				0.75 by 1 inch keys.
Do.....	For chassis to racer.	do.....	6				1 by 2 inch keys.
Ladder.....	To sight-standard platform.	Wrought iron...	1				
Do.....	To top-carriage platform.	do.....	1				
Do.....	To pit.....	do.....	1				
Ladder braces.....	Ladder to pit.....	do.....	2				2 sizes.
Do.....	Sight, stand, ladder, and chassis.	do.....	1				
Do.....	On top carriage.....	do.....	2				Right and left.
Lifting hooks.....	With carriage.....	Steel.....	4				
Locking screw.....	Front end of cylinder.	do.....	2	0.75	1.6		
Name plate.....	On right chassis....	Bronze.....	1				
Oil plugs.....	In carriage.....	Brass.....	1				0.625-inch tap.
Do.....	do.....	do.....	1				0.375-inch tap.
Oil can.....	With carriage.....	do.....	1				Capacity, 1 quart.
Do.....	do.....	do.....	2				Capacity, 3 pint.
Pawls.....	For crosshead, on fulcrum.	Forged steel, No. 3.	2				Right and left.
Pawl fulcrums.....	In chassis, for crosshead pawls.	do.....	2			2	1½-inch nuts.
Pawl levers.....	On pawl fulcrum...	do.....	2				1 right, 1 left.
Pawl-lever links.....	From pawl lever to pawl-lever crank.	Steel.....	2				
Pawl-lever link pins..	In links.....	Bronze.....	4				
Pawl-lever cranks.....	On tripping shaft...	Steel.....	2				
Pawl safety latch.....	On latch stud.....	do.....	1				
Pawl safety-latch stud.	On right chassis....	do.....	1				With bronze washers.
Pawl safety-latch spring.	From latch to chassis.	Spring steel....	1				
Pawl safety-latch spring pins.	In chassis and latch	Steel.....	2				
Pawl safety-latch dog.	On crosshead.....	do.....	1				
Pawl safety-latch stop.	Chassis (front end).	do.....	1	.5	4.1		
Pawl springs.....	Crosshead pawls and pawl levers.	Spring steel....	2				
Pawl-spring pivots...	On pawl lever.....	Steel, forged....	2				
Do.....	On crosshead pawl..	do.....	2				
Pawl-stop crosshead..	Pawl lever.....	Steel.....	2	.5	1.0		
Pawl washers.....	On pawl fulcrum...	Bronze.....	6				
Pinch bars.....	With carriage.....	Steel.....	2				
Pinch-bar hooks.....	Side of chassis....	do.....	4				
Pipe.....							
Equalizing.....	Between recoil cylinders.	Copper.....	1				In 2 parts.
Straps.....	Over equalizing pipe.	Wrought iron...	2				
Glands.....	At ends of equalizing pipe.	Steel.....	2				
Followers.....	do.....	Bronze.....	2				
Packings.....	do.....	Flexible vulcanized fiber.	2				
Equalizing coupling.	Connects equalizing pipe and valve.	Bronze.....	2				

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Pistons and rods.....	In recoil cylinders..	Forged steel No. 3.	2	In.	In.	4	Nuts, 10 threads per inch.
Piston liners.....	Pistons.....	Bronze.....	8				Fastened with 1-inch steel pins.
Platform, sight standard.	In rear of left chassis.	Rolled iron.....	1				
Platform, top carriage.	On right recoil cylinder.	.....do.....	1				
Platform braces.....	For sight-standard platform.	Wrought iron...	1				
Do.....	For top-carriage platform.	.....do.....	1				
Platform handrail.....	Top-carriage platform.	.....do.....	1			4	0.75-inch nuts.
Do.....	On sight-standard platform.	.....do.....	1			8	1-inch pipe elbows and nuts, with pipe threads.
Platform screen.....	Attached to frame..	Wire netting...	1				
Platform-screen frame.	Sight-standard platform.	Wrought iron...	1				0.75-inch pipe with elbows.
Plugs, filling.....	Tops of recoil cylinders.	Bronze.....	6				4 of the plugs in reserve. Flexible vulcanized-fiber washers.
Racer:							
Inner.....	On traversing rollers.	Cast steel, No. 1.	1				
Exterior.....	.....do.....	Cast iron and steel.	1				In 6 segments—5 cast iron, No. 2; 1 cast steel, No. 1.
Racer clips.....	On exterior racer...	Cast steel, No. 1.	2				
Ratchet wheel.....	On retraction-gear shaft.	Steel.....	1				One 0.5-inch key.
Ratchet-wheel pawl...	Clutch bracket.....	.....do.....	1				
Ratchet-wheel pawl pin.	.....do.....	.....do.....	1				
Retraction crank-shaft pinion.	Crank shaft.....	.....do.....	1				18 teeth, 4 pitch. One 0.5-inch key.
Retraction intermediate bevel gear.	Clutch shaft.....	Bronze.....	1				22 teeth, 3 pitch. One 0.5-inch key.
Retraction vertical-shaft pinion.	Vertical shaft.....	Steel.....	1				12 teeth, 3 pitch. One 0.4-inch key.
Retraction vertical-shaft gear.	.....do.....	Bronze.....	1				36 teeth, 4 pitch. One 0.4-inch key.
Retraction bevel pinion.	Retraction-gear shaft.	Steel.....	1				15 teeth, 3 pitch. One 0.5-inch key.
Retraction bevel gear.	Retraction spur-pinion shaft.	Cast steel.....	1				45 teeth, 3 pitch. One 0.5-inch key.
Retraction spur pinion.	In retraction-gear bracket and chassis.	Steel.....	1				12 teeth, 2 pitch. Pinion and shaft one forging.
Retraction spur gear..	Retraction-drum shaft.	Cast steel, No. 1.	1				60 teeth, 2 pitch. Two 0.75-inch keys.
Retraction drum shaft.	In chassis.....	Forged steel, No. 3.	1				Two 0.75-inch keys.
Retraction gear shaft.	Clutch and retraction gear bracket.	Steel.....	1				
Retraction crank shaft.	Front of chassis...	.....do.....	1				Also for traversing.
Retraction vertical shaft.	Traversing and vertical shaft brackets.	.....do.....	1				Do.
Retraction ropes.....	From gun lever to chain drum.	Cast steel.....	2				2 loops and 20 pins.
Retraction-rope drum.	Retraction-drum shaft.	Cast iron, No. 2..	1				Right hand.
Do.....	.....do.....	.....do.....	1				Left hand.
Retraction-rope fasteners.	Retraction drum...	Steel.....	2				
Retraction-rope guards.	From buffers to drums.	.....do.....	2				

Also for traversing.

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued *

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
				In.	In.		
Retraction-rope guard brackets.	Rope guard to rear transom.	Steel.....	2				
Retraction-rope pulleys.	In buffer bracket...	Cast iron, No. 2..	2				
Retraction-rope pulley axles.	.....do.....	Steel, No. 3.....	2				Washer and pin.
Retraction cranks....	Crank shaft.....	Steel.....	2				Also for traversing.
Retraction-crank handles.	Retraction crank....	.....do.....	2				Do.
Retraction-crank sleeves.	Retraction-crank handle.	Brass tubing.....	2				Do.
Retraction-crank handle washers.	.....do.....	Steel.....	2				Do.
Retraction hand-wheel.	Retraction-gear shaft.	Bronze.....	1				0.75-inch set screw.
Rollers:							
Recoil.....	On top of chassis...	Forged steel, No. 3.	26				
Traversing.....	On inner base ring..	.....do.....	24				
Do.....	On exterior base ring.	.....do.....	48				
Roller frames, recoil.	Taking recoil rollers.	Steel.....	2				Each with 2 sides.
Roller-frame stays....	In recoil-roller frame.	.....do.....	24				
Roller-frame end pieces.	At ends of recoil-roller frame.	.....do.....	4				
Roller-frame pins.....	Through end pieces.	.....do.....	4				
Roller bearings.....	In retraction-chain pulley.	.....do.....	2				Bronze cages.
Do.....	In right chassis and retraction-shaft bracket.	.....do.....	2				Do.
Do.....	In traversing shaft bracket and in exterior racer.	.....do.....	2				Do.
Do.....	In left chassis.....	.....do.....	1				Do.
Rope stop.....	Bolted to rope drum.	Cast steel.....	2				1 right and 1 left.
Screws, round-head...	Azimuth pointer...	Brass.....	2	0.5	0.75		
Do.....	Covers on exterior racer.	.....do.....	12	.375	.5		
Do.....	Name plate.....	.....do.....	2	.25	.5		
Do.....	Elevation pointer....	.....do.....	4	.5	.75		
Do.....	Ball-bearing cover....	.....do.....	3	.125	.25		
Do.....	Worm-wheel cover....	Wrought iron....	9	.375	.5		
Do.....	Elevating-rack cover door lock.	.....do.....	7	.375	.5		
Do.....	.....do.....	.....do.....	1	.5			Special, with nut and washer.
Do.....	Front stuffing box..	Steel.....	2	.75	1.6		
Do.....	Retraction hand-wheel.	.....do.....	1	.75	1.75		Set screw.
Screws, cheese-head..	Roller-bearing dust guard.	Wrought iron....	6	.375	1.35		
Do.....	Training rack.....	.....do.....	87	.625	1.9		
Do.....	Elevating-rack stops.	.....do.....	3				Special, 2 sizes.
Do.....	Elevating-rack guides.	.....do.....	14	1.0			Special.
Do.....	.....do.....	.....do.....	16	1.25			Do.
Screws, counter-sunk.	Roller-bearing dust guard.	Brass.....	6	.25	6.0		
Do.....	Separator, exterior distance rings.	Wrought iron....	24	1.0	11.7	24	Do.
Do.....	Azimuth circle.....	Brass.....	156	.25	.5		
Do.....	Separator, inner distance rings.	Wrought iron....	12	1.0	15.0	12	Do.
Do.....	Azimuth pointer lid hinge.	Brass.....	3	.5	1.0		
Do.....	Door hinge.....	Wrought iron....	4	.5	1.35	4	
Do.....	Oil holes in racer....	.....do.....	6	.625	1.0		
Do.....	Gun-lever trunnion liners.	Brass.....	16	.75	1.5		
Do.....	Pawl safety-latch dog.	Wrought iron....	3	.5	1.8		
Do.....	Crosshead liners....	Brass.....	24	.625	1.0		

[No. 1693]

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
				<i>In.</i>	<i>In.</i>		
Screws, countersunk.	Crosshead liners.	Brass.	12	.625	3.0		
Do.	Top-carriage trunnion bushing.	do.	16	.75	1.5		
Do.	Instruction plates.	do.	8	.25	.6		
Do.	Elevation graduation strip.	do.	20	.25	.5		
Do.	Bronze bushing in elevation stand.	do.	24	.25	.625		
Do.	Worm-wheel shaft bushing.	do.	8	.25	.625		
Do.	Top-carriage platform.	Wrought iron.	2	.75	1.85	2	
Do.	Sight standard screen.	do.	8	.375	.375		
Do.	Direction plates.	do.	2	.5	1.0		
Do.	do.	Brass.	16	.25	.625		
Do.	Floor plates to beams and racer.	do.	222	.5	.75		
Do.	Floor ring.	do.	16	1.0	1.6		
Do.	Rope stop to drum.	Steel.	4	.5	1.1		
Do.	Pawl safety-latch dog.	do.	3	.5	1.8		
Screws, headless.	Vertical shaft gear.	Wrought iron.	1	.5	.75		
Do.	Vertical shaft pinion.	do.	1	.5	.75		
Do.	Intermediate bevel gear.	do.	1	.625	.75		
Do.	Traversing bevel gear.	do.	1	.625	.75		
Do.	Clutch pinion.	Steel.	1	.625	.75		Set screw.
Do.	Ratchet wheel.	do.	1	.5	.75		Do.
Do.	Retraction bevel gear.	Wrought iron.	1	.625	.75		
Do.	Retraction bevel pinion.	do.	1	.625	.75		
Do.	Crank-shaft collar.	Steel.	1	.625	.75		Do.
Do.	Clutch-shaft collar.	do.	1	.625	.625		Do.
Do.	Gun levers and suspension-rod pins.	Wrought iron.	4	.75	1.0		
Do.	Roller frames.	do.	64	.5	1.25		
Do.	Elevating hand-wheel.	do.	2	.5	.75		
Do.	Elevating miter gear.	do.	6	.5	.75		
Do.	Elevating disk.	do.	2	.5	.75		
Do.	Elevating bevel gear.	do.	1	.5	.75		
Do.	Traversing pinion.	do.	1	.625	.75		
Do.	Yoke to valve stem.	Steel.	1	.375	.9		
Do.	Bushing to gun lever.	do.	2	.5	2.0		
Do.	Counter-recoil buffer.	do.	2	.5	.75		
Studs.	Gun-lever trunnion caps.	do.	4	2.0	8.5	8	4 nts, 2 inches high; 4 nuts, 1 inch high.
Do.	Top carriage cap-squares.	do.	4	2.0	10.0	4	
Do.	Rear stuffing box.	do.	28	1.0	4.5	28	
Do.	Elevating-arm caps.	do.	4	1.25	5.75	8	
Steps.	On chassis.	do.	1				Right chassis, front.
Do.	do.	do.	1				Right chassis, rear.
Stuffing-box heads.	Rear end of cylinders.	Cast steel.	2				
Stuffing boxes.	Front end of cylinders.	Bronze.	2				
Stuffing-box glands.	Stuffing boxes.	do.	4				In halves.
Stuffing-box followers.	do.	do.	4				
Suspension rods.	Through counterweights.	Forged steel, No. 3.	2				
Suspension-rod nuts.	On suspension rods.	do.	2				Do.
Suspension-rod pins.	In crosshead.	do.	2				
Sight standard.	Left piston-rod bracket.	Cast steel, No. 1.	1				

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Notes.	Remarks.
				In.	In.		
Sight-standard caps.	Sight standard.	Cast iron.	2				
Sight-standard set screws.	Sight-standard caps.	Steel.	2				
Sight-standard thrust plates.	do.	do.	2				
Shot tongs.	With carriage	do.	7				
Screw-driver.	do.	do.	1				Wooden handle.
Do.	do.	do.	1				
Top carriage.	On recoil rollers	Gun iron.	1				
Top-carriage cap-squares.	On top carriage	Cast steel, No. 1.	2				
Top-carriage eye-bolts.	Top-carriage cap-squares.	Wrought iron.	2				
Thrust plates.	Under basering for leveling.	Steel.	28				
Thrust washers.	On worm-wheel shaft.	Balata.	3				
Do.	do.	Bronze.	1				
Do.	Between balata washers.	do.	2				
Thrust disk.	For worm shaft.	Hardened steel.	1				
Throttling bars.	In recoil cylinders.	Forged steel.	4				
Throttling valve:							
Stem.	Into valve seat.	Steel and bronze	1	1.0	9.45		Spline screw.
Seat.	Screwed into valve body.	Steel.	1				
Yoke.	do.	Bronze.	1				
Latch.	Riveted to valve body.	do.	1				
Gland.	Screwed into valve body.	do.	1				
Body.	Bolted to top carriage.	do.	1				
Padlock.	Through latch and yoke.	do.	1				Yale standard, No. 853.
Packing.	Between gland and valve body.	Garlock's.	a 5		.25 (b)		
Plug.	Screwed into valve body.	Bronze.	1				
Throttling pipes.	Connecting valve with rear end of cylinder.	Copper.	2				
Straps.	Supporting throttling pipes.	Wrought iron.	4				
Glands.	At end of throttling pipes.	Steel.	2				
Followers.	do.	Bronze.	2				
Packing.	do.	Fiber.	2				
Couplings.	Connects throttling pipe and valve.	Bronze.	2				
Throttling valve plug.	Valve body.	Steel.	1				
Transom:							
Rear.	Between chassis.	Cast steel, No. 1.	1				
Front.	do.	do.	1				
Traversing bevel gear.	Traversing-pinion shaft.	Bronze.	1				27 ¹ / ₂ teeth, 3 pitch, 0.5-inch key.
Traversing pinion.	do.	do.	1				12 teeth, 2 pitch, 0.5-inch key.
Traversing-pinion shaft.	In exterior racer.	Forged steel.	1				
Training rack.	Attached to exterior base ring.	do.	1				544 teeth, 2 ¹ / ₂ pitch, 13 pieces.
Tripping shaft.	In tripping-shaft brackets.	Steel.	1				
Tripping-shaft brackets.	On chassis.	Cast iron.	2				
Tripping lever.	On tripping shaft.	Steel.	2				
Tripping-lever rests.	On floor plate.	do.	2				
Wedges, leveling.	Under base rings.	do.	24				

a Rings.

b Square.

[No. 1093]

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Wrenches.....	Spanner wrench, stuffing-box follower.	Steel.....	1	In.	In.		
Do.....	For cylinder-head nuts.	do.....	1				
Do.....	For filling plugs....	do.....	1				
Do.....	For piston-rod nuts.	do.....	2				
Do.....	For 1-inch and 1½-inch nuts.	do.....	1				
Do.....	For 1-inch and 1½-inch nuts.	do.....	1				
Do.....	For 1½-inch nuts....	do.....	1				
Do.....	For 2-inch nuts....	do.....	1				
Do.....	For foundation bolts.	do.....	1				Socket wrench.
Wrench handle.....	For foundation-bolt wrench.	do.....	1				

AMMUNITION TRUCKS.

[Three for each carriage.]

Adjusting hand-wheel.	In hand wheel bearing.	Bronze.....	1				
Adjusting hand-wheel stop.	Adjusting hand-wheel.	Steel.....	1				
Adjusting nut.....	On elevating screw.	Bronze.....	1				
Adjusting nut stop....	Adjusting nut.....	Steel.....	1				
Adjusting nut support.	For elevating screw.	do.....	1				Riveted down.
Do.....	For handwheel elevating screw.	do.....	1				Do.
Ball-bearing washers...	Casters.....	Hardened steel..	4				Top and bottom.
Ball-bearing covers...	do.....	Bronze.....	2				
Ball-bearing balls.....	Between washers...	Steel.....	38	1½			2 bearings.
Ball-bearing washers...	Elevating screw....	Hardened steel..	2				Top and bottom.
Ball-bearing cover....	do.....	Bronze.....	1				
Ball-bearing balls.....	Between washers...	Steel.....	18	0.5			1 bearing.
Ball-bearing washers...	Elevating hand-wheel screw.	Hardened steel..	2				Top and bottom.
Ball-bearing cover....	do.....	Bronze.....	1				
Ball-bearing balls.....	Between washers...	Steel.....	26	.5			1 bearing.
Ball-bearing washers...	Elevating wheel....	Hardened steel..	2				Top and bottom.
Ball-bearing band.....	do.....	Copper.....	1	1½			
Ball-bearing balls.....	Between washers...	Steel.....	75	1½			1 bearing.
Bearing, handwheel....	On top plate for handwheel screw.	do.....	1				1 riveted down.
Bearing, screw.....	On top plate for elevating screw.	do.....	1				Do.
Bolts, hexagonal.....	Crank-shaft bracket.	Wrought iron...	8	.5	1.25	8	
Do.....	Axle to front frame.	do.....	3	.75	2.75	3	
Do.....	Caster bracket to rear frame.	do.....	4	.75	1.75	4	
Do.....	Brake-shaft bracket.	Steel.....	6	.5	1.2		
Do.....	Brake lever.....	do.....	1	.5			
Do.....	Caster bracket to rear frame.	do.....	2	.75	1.375		
Brake lever.....	On brake shaft....	do.....	1				
Brake shaft.....	Through brake-shaft bracket.	do.....	1				2 keys and 2 spline screws.
Brake-lever spring....	On brake lever....	do.....	1				
Brake shoe.....	On brake shaft....	Cast iron.....	2				
Brake-shaft bracket...	Bolted to frame....	Bronze.....	2				
Crank.....	On side of truck....	Wrought iron...	1				Right and left.
Crank shaft.....	In crank-shaft bracket.	Steel.....	1				With brass sleeve.
Crank-shaft brackets..	Bolted to side of truck.	Bronze.....	2				1 bored 1 inch diameter; 1 bored 1.15 inches diameter.
Cartridge shelves.....	On sides of truck...	Steel.....	2				With braces.
Caster pins.....	Through yoke.....	do.....	2			2	With split pins.

[No. 1893]

Names of parts of 10-inch disappearing carriages, A. R. F., model of 1896, etc.—Continued.

AMMUNITION TRUCKS—Continued.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Nuts.	Remarks.
Caster yoke.....	In caster bracket...	Cast steel.....	2	In.	In.	2	Right and left; 2 washers.
Caster brackets.....	Bolted to frame.....	do.....	2				Right and left.
Caster bushings.....	In caster bracket.....	Bronze.....	2				
Caster wheels.....	In caster yokes.....	Cast steel.....	2				
Elevating screws.....	For shot tray.....	Steel.....	2				Right and left hand thread.
Frame:							
Front.....	Combining wheels and parts.....	do.....	1				1½ by 1½ by ¼ inch angle.
Rear.....	do.....	do.....	1				Do.
Braces.....	Corner pieces for frame.....	do.....	4				Front and rear, 2 shapes.
Front axle.....	Bolted to front frame.....	do.....	1			2	With pins and washers.
Front wheels.....	On front axle.....	Cast steel.....	2				
Filler piece.....	On shot tray.....	do.....	1				
Filler-piece hinge.....	Riveted to shot tray.....	do.....	1				
Filler-piece hinge pin.....	Through hinge.....	Steel.....	1	1			With 0.25 split pin.
Gear-wheel nut, elevating.....	On elevating screw.....	Bronze.....	1				43 teeth.
Gear wheel, elevating.....	On elevating hand-wheel screw.....	do.....	1				43 teeth; 0.5-inch key.
Gear pinion, elevating.....	Crank shaft.....	Steel.....	1				17 teeth.
Handle.....	For moving the truck.....	Wrought iron.....	1				Complete.
Hinges for handle.....	Riveted to frame.....	Steel.....	2				Right and left.
Hinge pin.....	Through hinge for handle.....	do.....	1	0.75			2 washers and pins.
Oil plugs.....	In truck.....	Brass.....					0.375 tap.
Screws.....	Ball bearing for caster.....	do.....	6	.125	0.25		Round head.
Do.....	Ball-bearing cover.....	do.....	6	.125	.2		Do.
Do.....	Handwheel stop.....	do.....	2	.25	.5		Do.
Do.....	Elevating pin.....	Steel.....	2	.5	1.0		Headless screw.
Screws, headless.....	Brake shoe.....	do.....	2	.5	.75		
Shot tray.....	In elevating screws.....	do.....	1				
Shot-tray brackets.....	Riveted on shot tray.....	Cast steel.....	2				
Shot-tray pins.....	In shot-tray bracket.....	Bronze.....	2				With split pin.
Top plate.....	Riveted on top of frame.....	Steel.....	1				

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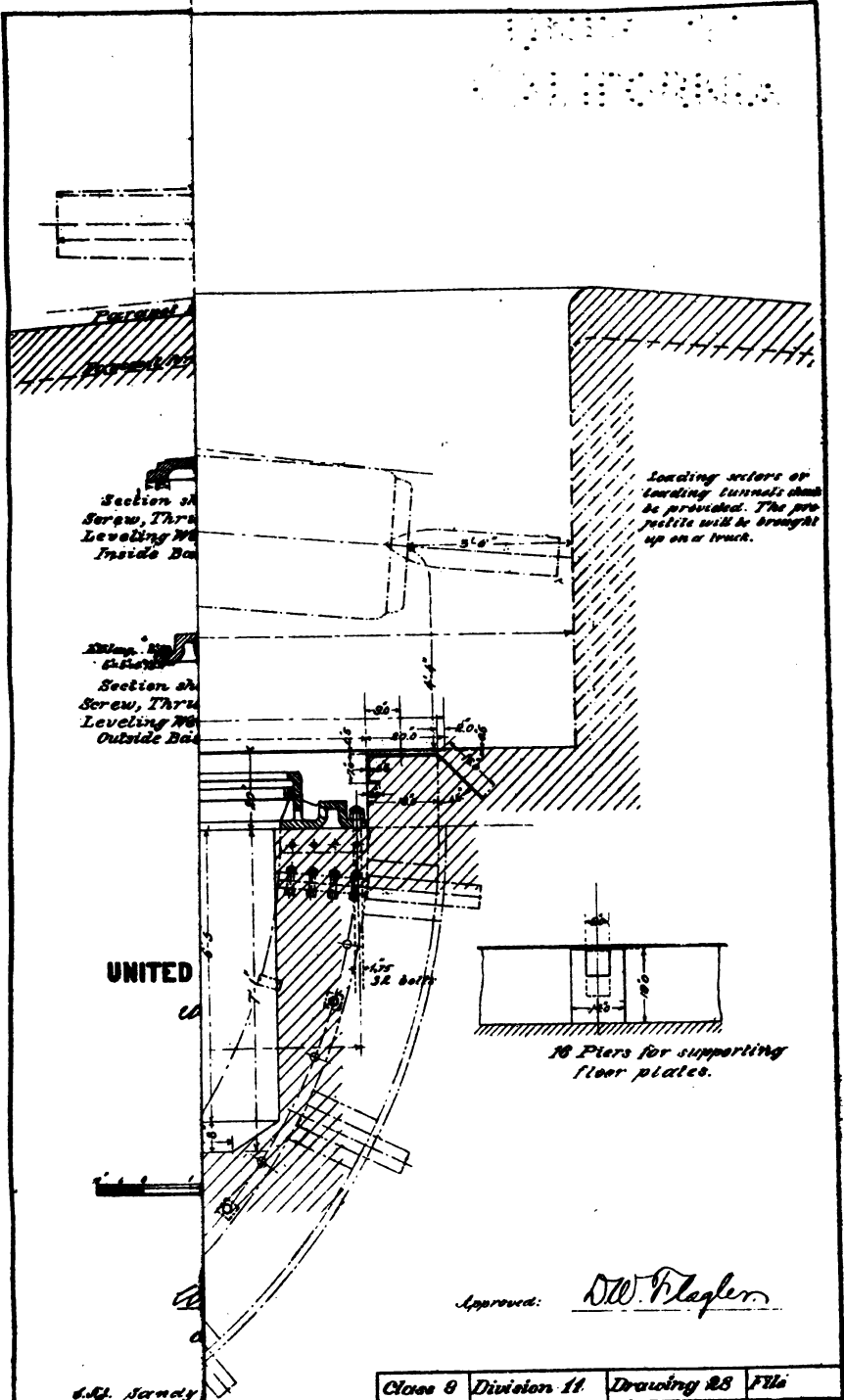
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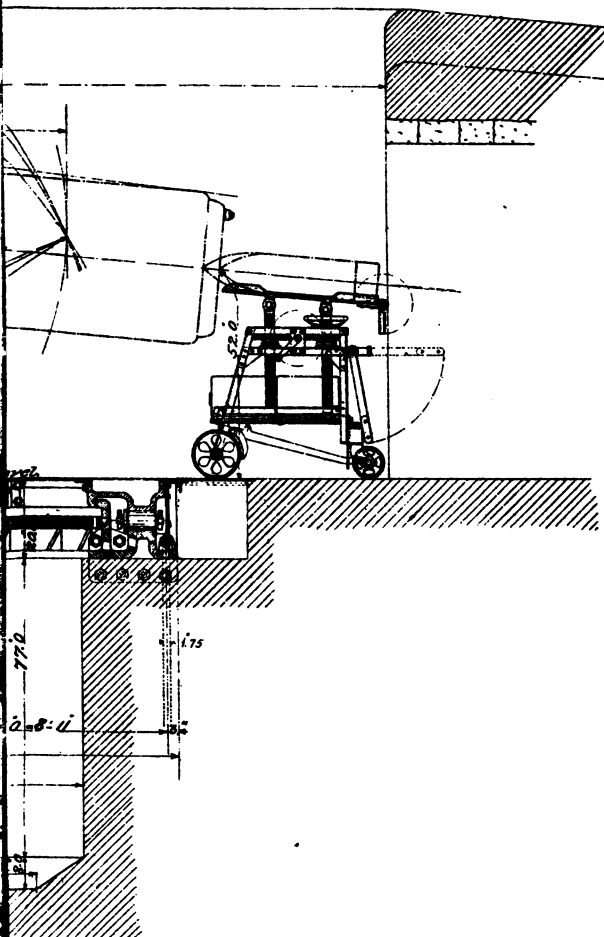
Revised Dec. 21, 1907.

Ed. Aug. 25-17-500.



PLAN OF CALIFORNIA

Reference for 2500
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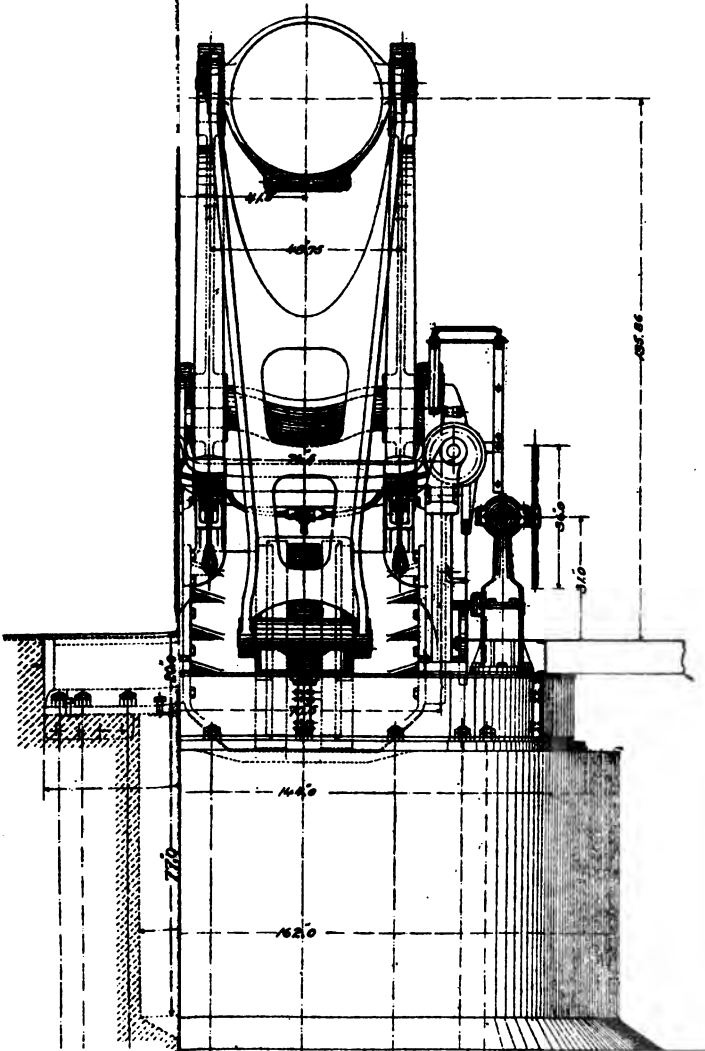
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Division 11

Drawing 1

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TYPE OF CANNON



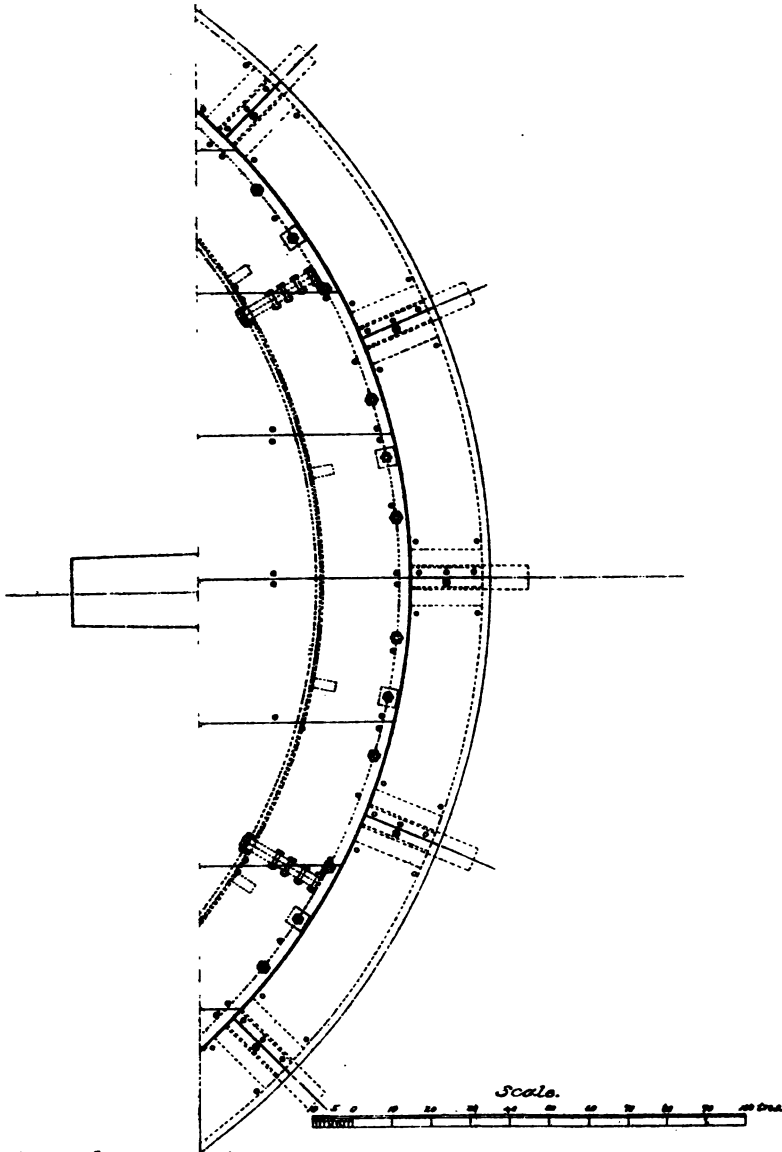
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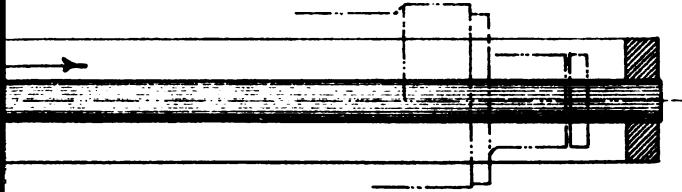


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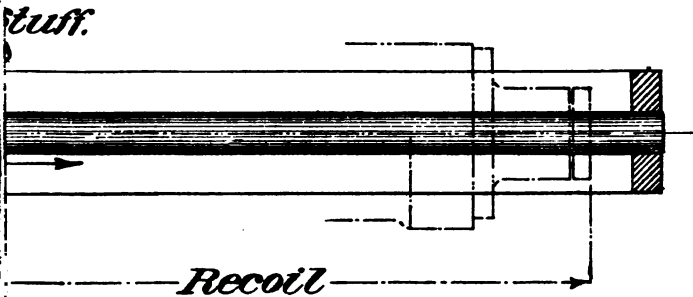
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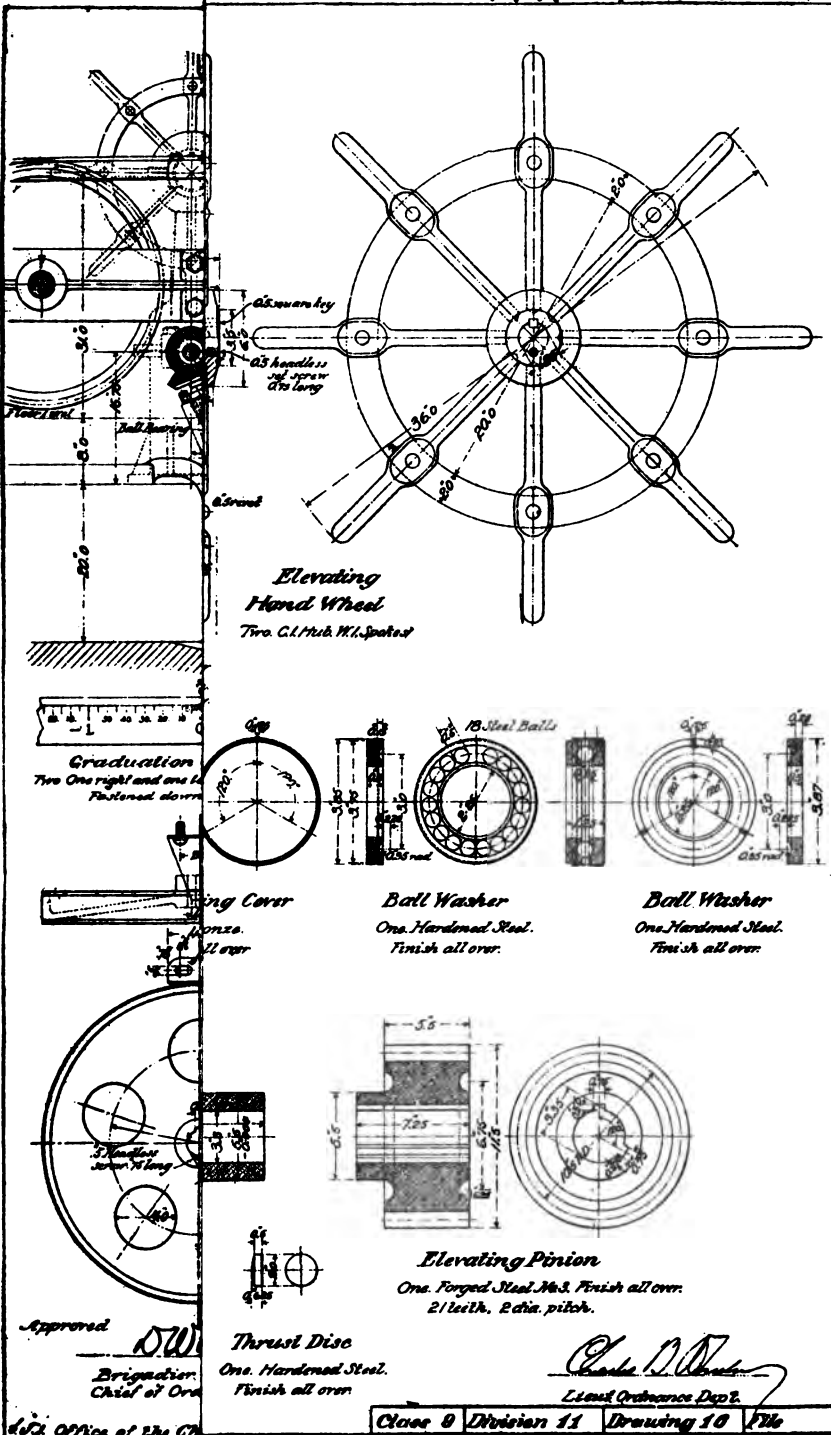
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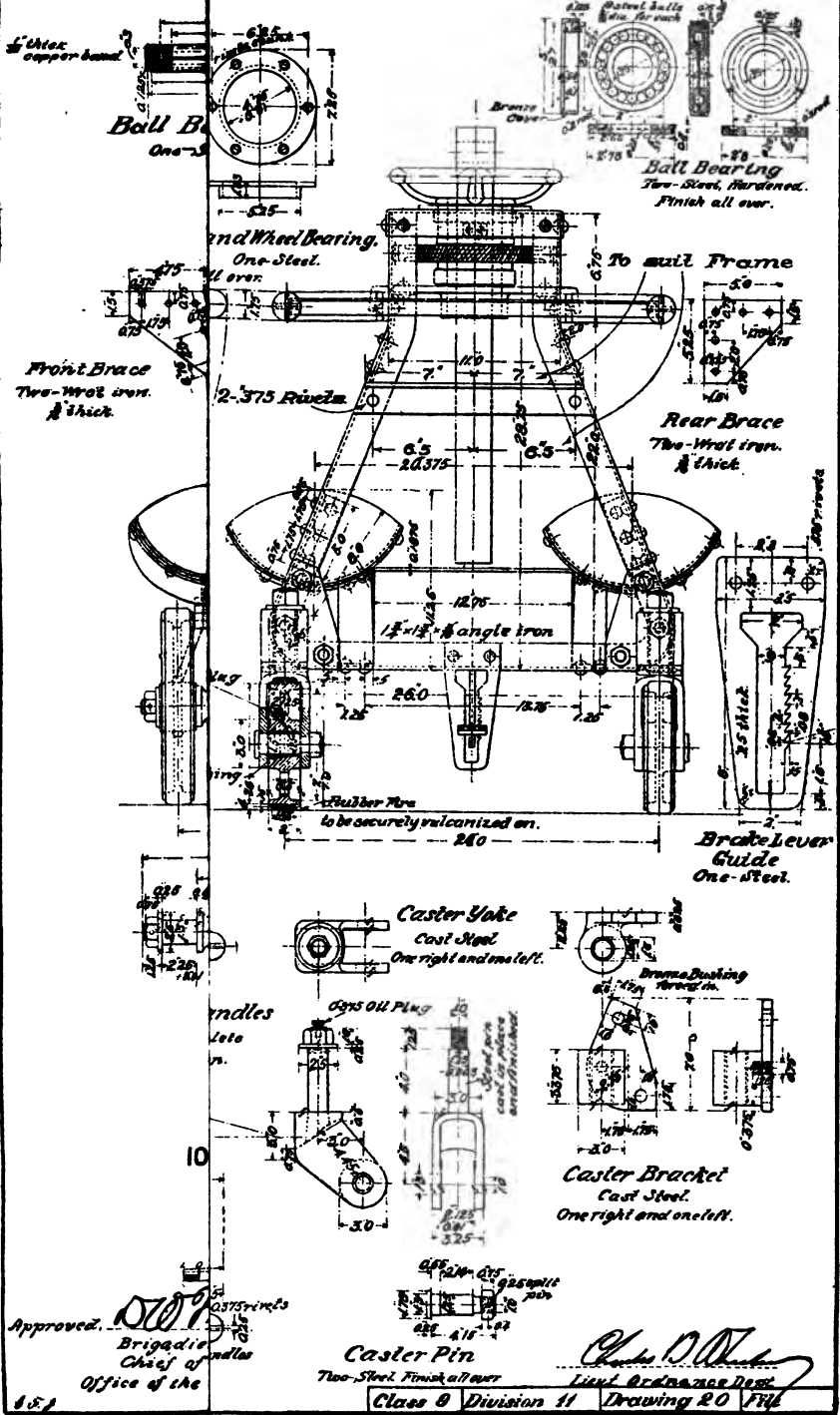


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John G. Dyer
Lieut. Col. Ord. Dpt. U.S.A.
Commanding.

Class 15	Division 0	Drawing 1	File
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